

# DAU

## **Defense Acquisition University Guide**

**for Curriculum Development,  
Delivery, and Evaluation**



**November, 1997**

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## FOREWORD

The Defense Acquisition University (DAU) is moving into a new era of delivering education and training in a technologically-based environment. This DAU Guide for Curriculum Development, Delivery, and Evaluation is provided to assist DAU faculty and staff with current information on policies, training, course design, and evaluation. The Guide is available through the world-wide web with added links and resources to broaden the perspective and knowledge of the user. It can be used as an electronic resource document and also a communication link among the faculty. The Guide is an evolutionary tool, and will be updated on-line as changes occur. I encourage you to visit the DAU website where the Guide resides, to learn, comment and share information.

A handwritten signature in black ink, reading "Thomas M. Crean".

Thomas M. Crean  
President  
Defense Acquisition University

## **DAU CURRICULUM GUIDE DEVELOPMENT COMMITTEE**

The DAU Guide for Curriculum Development, Delivery, and Evaluation was planned and developed by the DAU Curriculum Guide Development Committee with the full cooperation of the DAU consortium schools.

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## Section I

# Introduction to Department of Defense Acquisition Education and Training

### Overview

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#### Background

The Defense Acquisition Workforce Improvement Act of 1991 created the Defense Acquisition University (DAU). DAU operates a consortium of Army, Navy, Air Force, National Defense University, Defense Logistics Agency schools and activities. The DAU coordinates and tailors education and training to the needs of the acquisition component within the DoD community. It is the DoD center for developing education, training, research, and publication capabilities in the area of acquisition.

In an effort to provide consistency with course and curriculum development, DAU appointed a group of individuals representing consortium schools to serve on the DAU Curriculum Development Guide Committee. One of its tasks is to create a document that provides for the development of effective courseware products for delivery by DAU schools.

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#### Purpose

The DAU Guide for Curriculum Development, Delivery, and Evaluation provides a common foundation for DAU and its member schools to prepare, review, and evaluate instructional products. The purpose of the Guide is to provide tools for the development, delivery, and evaluation of effective education and training. Accordingly, the Guide provides:

- guidance for designing DAU performance-based curricula;
  - a structure for using the guidance to develop new and review existing instructional materials
  - support materials (definitions, examples, job aids, etc.) which
    - define the criteria, and
    - assist instructional design developers/reviewers in completing or evaluating instructional design quality; and
  - a system for evaluating instructional design quality.
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## Overview, Continued

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**Purpose,  
continued**

Performance-based training and education presents providers with an opportunity to apply adult learning methodology, technology-based instructional design, multi-media development, and performance-based assessment techniques.

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**In this section**

This section covers the following:

Topics	See Page
About This Guide	1–2
What Is Performance-Based Training and Education?	1–4
What Is Competency-Based Training and Education?	1–7
Section Summary and References	1–8

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**Primary audience**

The Defense Acquisition University (DAU) *Guide for Curriculum, Development, Delivery, and Evaluation* is for those individuals who are involved in the design, development, delivery, and evaluation of DAU training and education courses. These include:

- Instructors
  - Education specialists
  - Instructional systems designers
  - Functional board members and their representatives
  - Subject matter experts
  - Contractors
-

## About This Guide

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### Introduction

No single document can solve the full range of potential instructional systems design problems. This *Guide* will focus on phases of the instructional system development of performance-based training and education and rapid prototype processes to develop, maintain, and evaluate courses or curricula for the current DAU environment.

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### DAU policy guidance

The *DAU Guide for Curriculum Development, Delivery, and Evaluation* is NOT a policy document, although it is intended to be consistent with applicable existing policy established by the DAU. You may view these documents on the DAU homepage. The website is:  
<http://www.acq.osd.mil/dau>.

DAU Policy Memoranda	Title
Policy Memorandum #1	<i>New Course Development, Revision, and Maintenance</i>
Policy Memorandum #2	<i>Course Sponsor and Offeror Requirements</i>
Policy Memorandum #3	<i>Student Attendance</i>
Policy Memorandum #4	<i>Academic Program Review</i>
Policy Memorandum #5	<i>Course Equivalency</i>

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### Instructional systems development (ISD) phases

The following are the instructional systems development phases addressed in this guide:

If you need to know about . . .	Then go to . . .
Overall ISD Process and Rapid Prototyping	Section 2
Analysis	Section 2
Design	Section 4
Development and Implementation (Delivery Methods)	Section 5
Technology-Based Education and Training	Section 6
Evaluation: Learner Performance	Section 7

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## What is Performance-Based Training and Education?

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### Introduction

The acquisition educational environment is changing. DAU schools must prepare students for the future by preparing them to become lifelong learners who can work with others, communicate clearly, think critically, apply what they have learned in practical ways, recognize quality, and be creative as well as original problem solvers.

Performance-based training and education ensures that learners *master* the knowledge, skills, and abilities that emphasize application and use of what has been learned. It clearly defines what they are expected to know and be able to do with that knowledge. Students are periodically tested or assessed to determine their progress, and each is given needed time and assistance to become proficient. Individuals who demonstrate meaningful progress or skill development are advanced to more challenging courses or curricula.

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### Differences between traditional testing and performance-based assessment

A traditional pencil and paper test requires that students show what they have learned. They do not have to demonstrate what they can do with what they know, and they are not asked to demonstrate the depth and breadth of their knowledge. Frequently grades are reported as the percentage of test questions answered correctly. It is possible to receive credit by mastering as little as 60-70 percent of the information.

In a performance assessment, students are expected to answer two questions: What do you know? And what can you do with what you know? Students show their basic knowledge and understanding through a variety of activities that demonstrate their level of proficiency. This kind of assessment not only requires thorough knowledge of the basic skills, but demands that students demonstrate their knowledge through projects, performances, experiments, research, essays, critiques, and other practical ways.

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## What is Performance-Based Training and Education?, Continued

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### Performance-based assessment standards

Most tests and assessments are purposeful. That is, they are used as *exit criteria*. Exit criteria are predetermined standards of acceptable student performance at the completion of a module, course, or curriculum.

Performance-based assessment standards are designed to describe the student's level of proficiency in meeting the *exit performance standards*. Performance standards take many forms, but generally revolve around the concept of *mastery learning*. Usually, however, a learner's performance is measured in *levels* of proficiency like those illustrated on the next page.

Performance assessments may be either pencil and paper or actual physical performance. This *Guide* provides more information about both tests and assessments in Section 6 Evaluation: Student Performance and Appendix G Test Assessment: Planning and Writing.

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### Examples of levels of performance

Performance-based assessments describe the student's level of proficiency or mastery in meeting the exit performance standards. For example:

If . . .	Then . . .
the learner demonstrates <i>minimum development</i> toward proficiency	the learner meets few of the basic requirements set forth in the <i>exit performance standards</i>
the learner is <i>developing toward proficiency</i>	the learner meets some, but not all, of the basic requirements. He or she has difficulty communicating.
the learner is <i>proficient</i>	the learner meets the basic requirements and communicates these concepts clearly and easily.
the learner is <i>advanced</i>	the learner goes beyond the basic requirements, demonstrates a thorough understanding of the exit performance standards, and communicates those concepts clearly and easily.

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## What Is Performance-Based Training and Education, Continued

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**Performance vs.  
competency-  
based training  
and education**

Performance and competency-based training are essentially the same. The initial move towards educational reform in the Department of Defense was for *Competency-Based Training and Education* (CBT & E). Use of either term is a matter of individual preference.

Performance-based training and education is a better descriptor because it applies to courses that are designed from job-task-analysis (competency-based), *or* courses that evolve from *needs or topics analysis*. In either instance, the design requires some kind of measurable or observable learner performance.

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## What Is Competency-Based Training and Education?

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### Introduction

Historically the Department of Defense viewed competency-based training and education as *job or occupation specific*. That is, an individual learner would concentrate on *mastering* the “competencies” associated with the government job series or classification (e.g., Contract Specialist).

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### The structure of CBT & E

Competency-based learning combines a primary focus on subject content with the individual interest of the learner. It requires a deep and consistent commitment to rigorous academic standards. That is, competency-based training and education takes a highly sophisticated approach to the importance of relevance in education by defining relevance with reference to the knowledge base of any given field.

In competency-based or performance-based learning designs, the student ultimately receives certification in a profession by demonstrating facility with both theory and practice. Both performance-based and competency-based interventions are designed around the concept of *mastery* learning.

There are different approaches to performance and competency-based designs. Competency-based designs usually evolve from job-task analysis (JTA) and are typically process or procedure oriented. Mastering such processes or procedures may prepare a person to perform the duties and tasks in a job or occupation, although effective *performance* may also include:

- Information management
  - Computer literacy
  - Interpersonal, cross-cultural, cross-occupational, and cross-national communication skills
  - Adaptability to rapid change
  - Increasing self-direction
-

## Section Summary and References

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### Summary

The *Guide for Curriculum Development, Delivery, and Evaluation* is DAUs approach to bringing together public law, policy, and instructional systems design. The *Guide* emphasizes the concept of performance-based education and training learning systems.

The long-range promise and ultimately the justification for performance-based-education and training is to increase student learning by improving the quality of instruction. Theoretically, this should occur as the direct consequence of improved instructor education programs, and continuing professional development of faculty.

In order to facilitate faculty development and to improve performance as educators, this *Guide* provides acquisition education and training professionals the necessary information to successfully engage in instructional systems design. Most of the material covered in the *Guide* can be explored at greater depths by enrolling in one of the many Professional Development in Education (PDED) courses made available to all consortium faculty by DAU.

This *Guide* is not a document that can be consumed in one setting. It is used best as a reference document. Each section is broken into specific units that affect the instructional systems development of DAU courses.

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### References

- Public Law 101-510 National Defense Authorization Act for Fiscal Year 1991 known as the Defense Acquisition Workforce Improvement Act
  - DAU Policy Memoranda March 1997 including:
    - New Course Development, Revisions, and Maintenance
    - Course Sponsor and Offeror Requirements
    - Student Attendance
    - Academic Program Review
    - Course Equivalency
-

## Section II

### Overview Of The Systematic Approach To Instructional Design and The Rapid Prototyping Model

#### Overview

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##### Introduction

The systematic approach to instructional design is a five-phase process that ensures education and training accomplishes the following goal:

*A practical, results-oriented instructional program which provides people with the skills and knowledge to do their jobs correctly, efficiently, and with confidence.*

The rapid prototyping model is currently being used by DAU to develop technology based courses in a nonlinear fashion. This approach has been used by software developers and is considered faster and more efficient, while still maintaining the focus on effectiveness.

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##### In this section

The following topics are covered in this section:

Topics	See Page
ISD Overview	2–2
Rapid Prototyping Model	2–8
Section Summary and References	2–10

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## ISD Overview

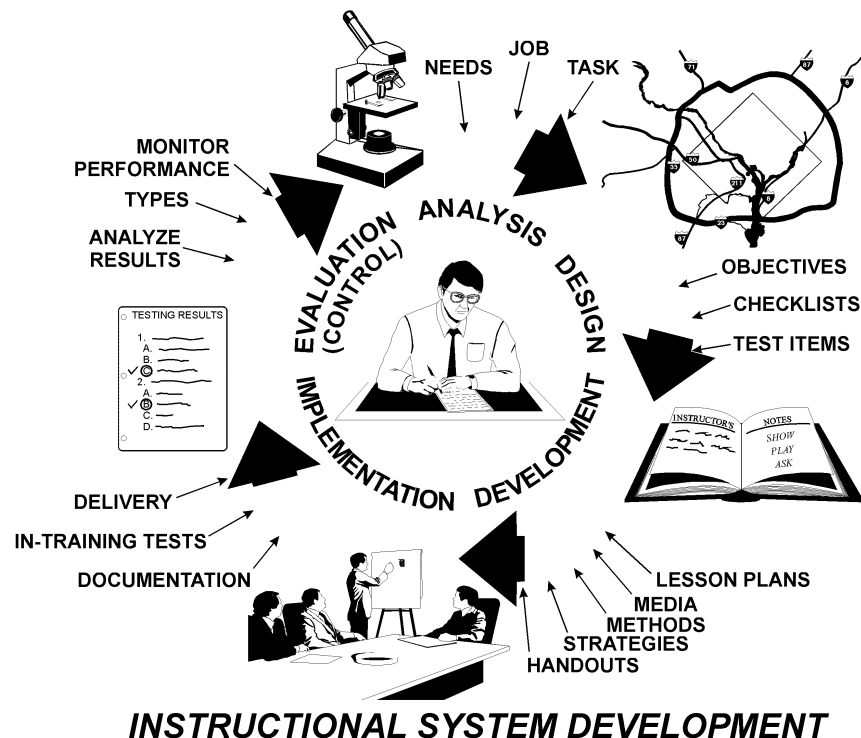
### Overview

The systematic approach and design model has many names; however, Instructional System Development (ISD) remains the standard. This model takes into consideration audience characteristics, the nature of the knowledge, skills, job, and tasks to be learned, and environmental constraints. ISD is a field that takes many of its concepts and principles from various disciplines. For example, as an *applied discipline*, ISD uses learning theory from psychology to determine how a person learns (learning style) and how to best address their learning need. Instructional theory uses that person's learning style to determine how to best develop instruction.

The five-phases of the ISD model are Analysis, Design, Development, Implementation, and Evaluation (ADDIE). It may be pictorially represented as a linear model, but the approach involves continuous iterations. Decisions made in one phase affect actions and plans in other phases.

### Instructional System Development

Graphic representation of this system approach.

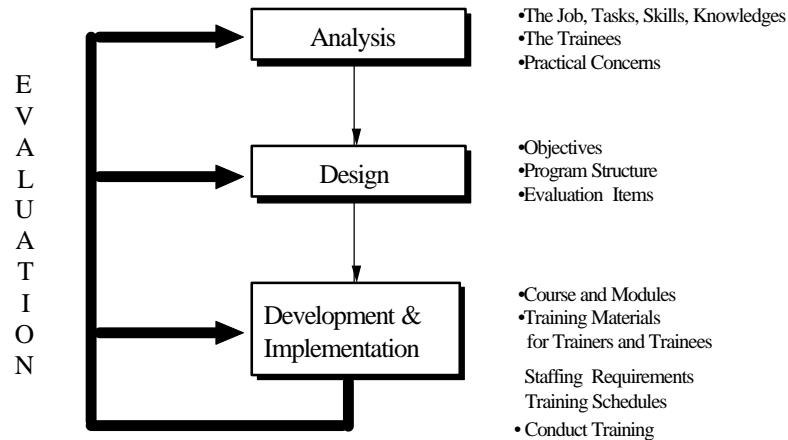


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## ISD Overview, Continued

### ISD Model

As this representation shows, evaluation is completed at the end of each phase in addition to an overarching evaluation.



### Analysis

Analysis provides a method of responding to changes in human resource requirements, solving job performance problems, and learning from “*real world*” experience. In the analysis phase, detailed practical studies are performed to determine what areas require instruction, learner characteristics, cost-effectiveness of a selected delivery system (e.g. Technology Based Training—TBT), and the scope, timeline, and budget of an education and training project or program. These facts are gathered to make informed development decisions and provides the linkage between the job and the instructional project or program.

The following types of analyses may be completed:

- Needs or Performance Analysis
- Audience or Learner Characteristics Analysis
- Job/Task Analysis
- Skill/Knowledge (Competency) Analysis
- Content, Learning and/or Instructional Analysis

*Continued on next page*

## ISD Overview, Continued

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### Design

Design uses the performance information collected earlier to help the instructional project/program take shape. The information gathered specifies, in measurable terms, the knowledge, skills, and aptitudes that the instruction will develop.

Learning objectives are developed for groups of related knowledge and skills. These written statements of learning outcomes define exactly when, what, and how well the learner must perform during instruction. Defining how individual tasks are performed focuses development efforts. In addition, the information gathered permits more effective decisions regarding:

- ⇒ How the learning materials will be organized and presented
- ⇒ Learning activities and instructional strategies to be included
- ⇒ Time spent on each topic
- ⇒ The use of presentation media
- ⇒ How learners will be evaluated

Assessment instruments (practical measures as well as written/knowledge tests) are produced to ensure that learning objectives are achieved and competencies are reliably evaluated.

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### Development

Development organizes the instructional materials needed for learners to achieve the learning objectives. Emphasis is on maximizing the use of existing materials and resources. Instructor and learner activities are defined and these activities describe how the instructor and learners will perform to achieve the learning objectives.

Existing, suitable instructional materials and lesson plans are selected and new ones are produced as needed. Resulting materials are reviewed for technical accuracy, tried out with a group of learners, and revised as necessary. Performance-based instructional materials are the products of this phase.

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## **ISD Overview, Continued**

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**Implementation**      Implementation is the process of putting the instructional program into operation. This finalized product is ready to be delivered to the target audience. If it is to be instructor-led or facilitated, instructors are selected and trained usually with a train-the-trainer session. Instruction is delivered as planned, and learner, and instructor, performance is evaluated.

These evaluations serve two purposes. First, they verify that learners have achieved the learning objectives. Second, learner evaluation results and instructor comments are useful for future program revisions and follow-up evaluation.

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**Evaluation**              The evaluation phase ensures continuing ability to produce qualified learners. A follow-up evaluation is conducted to assess how well the instruction prepares learners to perform their jobs after having been on the job for a specified period of time. Evaluation is the dynamic process of assessing performance, identifying concerns, and initiating corrective actions. Data sources for evaluation often include surveys, interviews, tests, course evaluation results, service or product data, and observations.

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## ISD Overview, Continued

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### **DAU Evaluation Program**

Success of any evaluation program depends upon a clear understanding of the intent or outcome. That is, evaluation in terms of what (reaction, learning, behavior, performance, or results)? The DAU evaluation program consists of four levels similar to Kirkpatrick's model. They are described in the table below. Student performance evaluation is covered in more detail in Section VI—Evaluation: Student Performance. The DAU Academic Review policy is covered in Policy Memorandum #5 Academic Program Review.

<b>Level</b>	<b>Outcome</b>	<b>DAU Program</b>
1. Reaction	How do learners feel about the program or like the course?	End of Course Critique
2. Learning	To what extent did the learner increase knowledge, improve skills, and/or change attitudes? How well did the student learn?	In class student assessment (Performance evaluation)
3. Behavior	To what extent did the learner's job behavior or performance change resulting from the education and training?	Post graduate survey
4. Results	What are the tangible results of the program in terms of reduced cost, improved quality and quantity?	Academic program review and resource graduate survey

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## Rapid Prototyping Model

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### Introduction

In today's environment of rapid change, there is a need for ISD processes that are quicker and more efficient, while still maintaining the focus on effectiveness. In the commercial arena, software developers have turned to rapid prototyping models to balance the challenges of maintaining high quality, while decreasing cycle time.

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### Overview

Rapid prototyping is a viable model for instructional design to use for *technology-based* forms of instruction. The processes do not occur in a linear fashion. For example, the completion of the analysis of the content is dependent on the knowledge gained from creating a prototype lesson. It reduces potential risks by having stakeholders review materials early in the process when changes can be made more cost effectively. Early reviews of completed course materials can reduce the development cycle by at least one-third.

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### In this section

This section will display the Rapid Prototyping model diagram.

Topics	See Page
Rapid Prototyping diagram	8
DAU Team Design/Development Process	8

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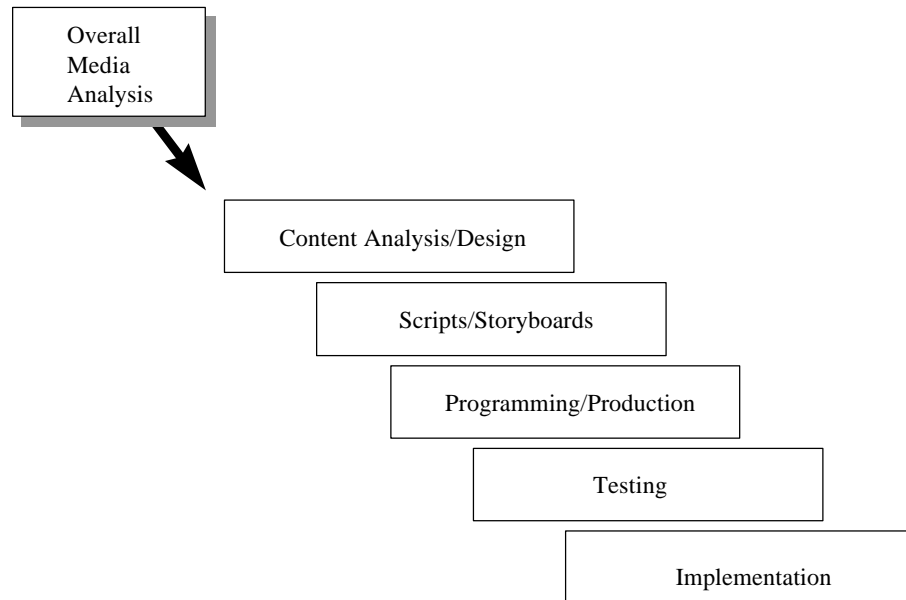
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## Rapid Prototyping Model, Continued

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### Rapid Prototyping Model

The figure below shows how the ISD steps are conducted in a rapid prototyping model. The overlapping boxes are meant to represent the fact that the processes do not occur in a linear fashion



### DAU team design/development process

The DAU Curriculum Design/Development team consists of the following :

- OSD functional board members
- DAU Academic Program Coordinator
- DAU education specialists
- Subject matter experts
- Contracted instructional designers
- Representatives from the school or curriculum development team.

A more detailed description of the process is described in Appendix B, DAU Technology-Based Redesign Process (Computer-Based Training).

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## Rapid Prototyping Model, Continued

The steps below illustrates the DAU team design/development process

Step	Action
1	Identify performance outcomes.
2	Develop course design guide.
3	Create scripts/prototypes.
4	Develop course materials.

**Step 1** Establishes specific performance outcomes for the course. Identify certification criteria and testing strategy.

**Step 2** Establish terminal and enabling learning objectives. Divide content into units. Select methods, media, and develop validation plan.

**Step 3** Convert course content into lesson scripts/storyboards. Develop exercises/interactions. Create prototypes of lessons, graphics, and interactions. Finalize test items.

**Step 4** Read course materials for pilot testing.

## Section Summary and References

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### Summary

The systematic approach to education and training provides a method for analyzing, designing, developing, implementing, and evaluating cost-effective, results oriented instructional programs. These guidelines were developed to describe the ISD systematic model. *These are development guidelines, not development requirements.* The rapid prototyping model on the other hand, enables the developer to create instructional materials for a technology-based environment in a nonlinear rapid paced method, more cost effectively, and in reduced time.

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## Section Summary and References, Continued

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## Section III

### Analysis

#### Overview

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##### Introduction

Analysis means to breakdown or take apart. Analysis is used in the ISD model to identify a performance deficiency or problem and to determine the solution to that deficiency. A job analysis is the method used to obtain a detailed listing of what activities (tasks) a particular job entails. Once identified, these activities (tasks) are ranked and a determination is made on which ones require training. The task analysis process describes what actions the job incumbent does in performing this task and what skills and knowledge the learner needs to accomplish this.

For those tasks that are not behaviorally or procedurally driven, i.e., those tasks that are more mental in nature—as in decision making—a content, learning, or cognitive analysis is completed. Frequently, even in the presence of a task analysis, designer/developers must ask how the information is best organized for learning.

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##### In this section

In this section the following topics are covered.

Topics	See Page
Types of Analysis, Terminology, and Methodologies	3–2
Preplanning Analysis	3–7
Job Analysis	3–9
Task Analysis	3–17
Content/Instructional Analysis	3–19
Section Summary and References	3–23

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## Types of Analyses, Terminology, and Methodology

### Overview

There are several different types of analysis. The types include but are not limited to the following:

- Needs or Performance Analysis
- Preplanning Analysis
- Job/Task Analysis
- Knowledge/Skill(Competency) Analysis
- Content/Instructional Analysis

Each of these can be used by itself or in combination. This section will cover questions to be answered by the various types of analysis, terminology common to all types, and methods for conducting the analysis.

**Types of analyses** Each type of analysis answers a different question.

Type	Question
Needs or Performance Analysis	Is it a training need? If so, how will it be satisfied?
Job Analysis	What tasks are performed in an identified job position?  Of these tasks, which ones will be selected for training?
Task Analysis	What are the components of each task within this job position?  What are the skills, knowledge, and abilities needed?
Knowledge/Skill(Competency) Analysis	What are the underlying skill and knowledge requirements ?
Content/Instructional Analysis	What are the underlying skill and knowledge requirements and how do they relate to task performance?  How can these skills and knowledge be organized to aid training design?

*Continued on next page*

## Types of Analyses, Terminology, and Methodology, Continued

### Terminology

The language of analysis.

Term	Example
<b>Job:</b> The name of an occupation	Military Police Officer Service Representative
<b>Duty:</b> A large segment of an occupation (job), an arbitrary clustering of related tasks into a broad functional area or general area of responsibility	Managing schedules Monitoring Contracts Preparing reports
<b>Task:</b> A unit of work activity that constitutes a logical and necessary event during job performance and that leads to a product, service, decision or change in the environment. The skills or competencies that the learner must obtain in order to be successful workers.	Produce contract schedule Initiate work request Verify Statement of Work
<b>Element:</b> A specific activity, often part of an ordered process, by which a task is performed; also called a “step”	Replace worn or damaged parts Enter password to access contractor information
<b>Skill:</b> Physical or mental activities that are needed to accomplish a job/task	Determine solutions Analyze a problem Manipulate figures in a formula
<b>Knowledge:</b> Items required to comprehend, recognize, and/or recall principles, rules, concepts, symbology, and terminology	How to locate specific data or kinds of data What something looks like Formulas to use
<b>Ability:</b> Capacity to acquire and use skills or knowledge	Language ability Mathematical ability Reasoning and problem solving ability Interpersonal ability

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## Types of Analyses, Terminology, and Methodology, Continued

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**Organizing tasks** It is very important to break the job down into major duties and then the major duties into tasks, and the tasks into its elements, skills and knowledge. This structure serves as an organizing scheme in curriculum design. In addition, it is unlikely that the instruction being developed will provide learners with all the necessary skills and knowledge they need if tasks have not been accurately and completely defined.

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**Generating task listing** There are several sources that may provide a task listing. It may come from

- an actual job/task analysis
- job performance requirements, and
- job descriptions.

If the list of tasks is not provided, a *jury of subject matter experts* (SMEs) is often convened to help generate and compile the list of tasks necessary to perform the total job.

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**Actual job/task analysis (AJTA)** **Job analysis** is the systematic process of identifying all tasks performed in a given job position.

**Task analysis** is the systematic process of clarifying selected tasks and identifying how to do the task and what is required to learn to do the task.

A job-task analysis (JTA) is most appropriate in analyzing observable, repetitious, and procedure-driven performance processes. However, this may not work well when the process is unobservable, requires complex decisions, and is not repetitious.

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**Data collection methods for JTA** The data collection methods include: observation, interviews, and panels of

- subject-matter experts,
  - occupational analysis centers, and
  - group interviews (also known as a table top or jury of experts).
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## **Types of Analyses, Terminology, and Methodology, Continued**

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**Panel of experts  
or jury of subject  
matter experts**

Generally there are two strategies that may be used to facilitate this panel or jury:

- Brainstorming
  - Index Card Method
- 

**Brainstorming**

Brainstorming is a group process that involves spontaneous contribution of ideas by all members of the group. The group interaction and discussion can be beneficial in developing the task inventory as this interaction may help uncover tasks that might have otherwise been overlooked.

As tasks are generated, they are written on large sheets of paper or easel pads and posted. All ideas should be accepted even though some may eventually be eliminated. Frequently, the tasks are then categorized or grouped around a central theme—things that go together to form a group—from which duty areas will be identified.

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**Index card  
method**

Generate categories of job events and have panelists write as many tasks as they can think of on an index card. Only one task per card. When all panelists have finished, have one person read each card aloud to check for duplicates among the panelists. Have all the panelists read their cards for this one category. Follow this method for each category.

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## Types of Analyses, Terminology, and Methodology, Continued

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**Knowledge/skill  
(competency)  
analysis**

This analysis is useful for performance processes that tend to be unobservable and include a great deal of individual judgment. Such processes tend to be nonlinear, do not necessarily follow a step-by-step procedure, and cannot be described in terms of flowcharts. This analysis is not appropriate for highly routine, procedural tasks.

Step	Action
1	Identify and list the knowledge and skills for a given job position.
2	Sequence the results in hierarchical or logical order.
3	Determine what type of information is required (see page 19).
4	Identify what decisions/problem solving/or information processing are required by the learner.
5	Structure the content flow (learning points) to include these variables.

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## Preplanning Analysis

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**Early concerns** Before beginning any major undertaking, it is always a good idea to ask several questions to determine the breadth and scope of the project.

---

If you need to know about...	Then conduct a(n)...
The intended audience	Audience Analysis.
The need or performance deficiency	Needs or Performance Analysis.
Parameters that affect the project	Constraints Analysis.
How training can best solve a performance problem	Training Needs Analysis.

---

**Audience analysis** An audience analysis gathers information for each of the potential audiences. It may include, but not necessarily be limited to:

- exact and similar job title(s)
  - audience size
  - geographic distribution
  - entry level skills and knowledge
  - formal and informal education
  - service or agency issues and/or
  - audience learning style (How do they learn best—by doing, hearing, seeing, thinking or a combination?)
- 

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## Preplanning Analysis, Continued

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### Needs or performance analysis

One of the first steps in the analysis phase is to conduct a needs or performance analysis, and, if appropriate, a needs analysis.

The purpose of the performance analysis is to determine:

- if a performance problem exists,
- the nature and cause of the performance problem (skill/knowledge, motivational, environmental, organizational, evaluation, and feedback),
- the impact of the performance problem, and
- an appropriate intervention (solution) to the performance problem.

Results of the needs or performance analysis are used to determine whether it is the intervention. (e.g., instruction, job aid, performance standards in a job description, job re-engineering, improving work site tools).

---

### Constraints analysis

A constraints analysis identifies the parameters that might affect the project. Such items might be:

- Who is making the request?
  - What are the time limitations?
  - Which, if any, regulations impact the training?
  - What resources and facilities are available and/or required?
  - What documentation and tools are available?
  - What equipment/processes are needed?
  - What are the physical work and instructional environments?
  - Are there additional constraints such as time, labor, money, etc.?
- 

### Training needs analysis

If instruction is the identified solution to a performance problem or deficiency, a training needs analysis looks at the question, *What does education and training need to do to solve this deficiency?* Answering this issue helps determine what resources will be committed to the development of the project.

---

## Job Analysis

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### Introduction

Job analysis is the process of examining career field or ratings, jobs, major duties and tasks of an existing job, or planning the duties and tasks of a new job. Within ISD, a job analysis is conducted for the purpose of establishing a manageable foundation for an instructional development project.

---

### Job analysis: goal

The goal of the job analysis is to develop a complete list of tasks associated with a selected job position, career field or rating. It can be as complex as identifying tasks for a complete field or related just to a single duty or the operation of a new piece of equipment.

The method to generate this complete list of tasks (known as a task inventory) is to identify the job, determine the major duties that make up that job and then those tasks which are associated with each duty.

*NOTE: AT THIS POINT ONLY IDENTIFY TASKS—DO NOT THINK EDUCATION AND TRAINING.*

---

### Job analysis overview

During job analysis, job incumbents and their supervisors share their knowledge and experience with analysts to develop a detailed list of education and training tasks required to perform a particular job or duty. **Job analysis** produces a list of valid tasks and obtains information related to those tasks, which is used to select tasks for education and training. These tasks are then further analyzed using the task analysis process. Data collection methods used during job analysis typically consist of documentation review, interviewing workers, conducting group meetings using a jury of subject matter experts, or conducting surveys using questionnaires.

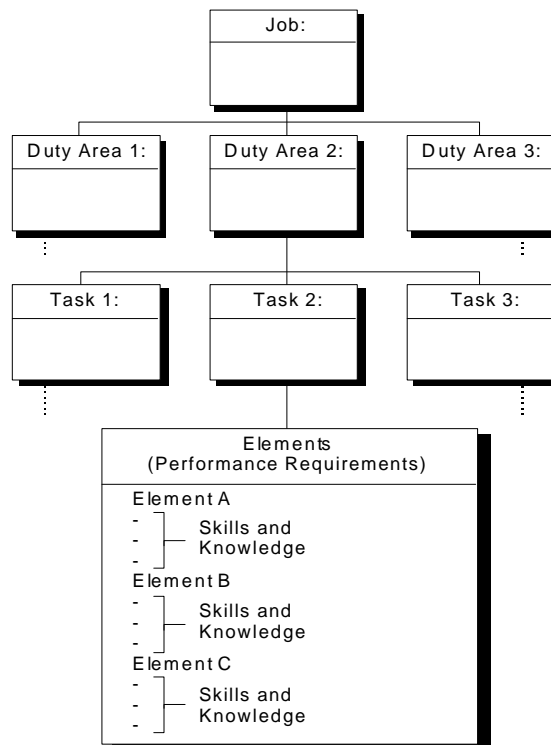
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## Job Analysis, Continued

**Structure of a job** There is general agreement on an overall structure through which most jobs can be analyzed. The usual pattern is illustrated here:



### Note

It is very important to break the job down into major duties and then the major duties into tasks. This structure serves as an organizing scheme in curriculum design. In addition, it is unlikely that the education and training being developed will provide learners with all the necessary skills and knowledge they need if tasks have not be accurately and completely defined.

*Continued on next page*

## Job Analysis, Continued

### Task statement requirements and guidelines

Once you have determined that the tasks identified are indeed tasks, they must be worded accurately. Below are some guidelines for writing task statements.

Requirement	Rule	Task Statement Example
Clarity	Use easily understood wording.	File Documents
	Use precise action verbs.	Supervise files
Completeness	Use complete statements, avoid abbreviations.	Evaluate Statement of Work (SOW)
	Avoid “and” as it implies two tasks.	
Conciseness	Be brief.	Complete all sections Identify all elements
	The subject “I” or “you” is understood.	
Relevance	<b>Do not</b> include attitudes, knowledge or experience requirements or required education and training.	

### Note

During the job analysis process it is helpful to also identify the conditions and standards of the task if possible. It is often the case that a group of tasks will have identical or nearly identical conditions.

*Continued on next page*

## Job Analysis, Continued

### Types of task conditions

The major items that need to be included in an accurate and complete statement of task conditions are listed below.

Item	Example
Tools and equipment	Personal Computer Calculator
Special job aids and manuals	Procedural checklist Acquisition Deskbook
Kind and amount of supervision	Task performed under close supervision Task performed as a member of a team
Special physical demands	Kneeling or squatting Unusually cramped positions
Location	Outdoors in all weather At contractor's location

### Task statement standards (products)

The standard of performance can be described by defining an acceptable product, process, or by defining both.

The standard should be defined in terms of an acceptable *product* if the

- product is observable and can be inspected
- process by which the product was produced cannot be easily observed and
- process is relatively unimportant as compared to the product.

*Product standards* are generally described in terms of accuracy, tolerances, completeness, format, clarity, the number of errors, and/or quantity (i.e., the number of work units produced per time unit).

*Continued on next page*

## Job Analysis, Continued

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### Task statement standards (processes)

The standard should be defined in terms of an acceptable *process* if

- performance of the task does not leave a readily observable product and/or
- failure to use the correct process could result in damage to equipment or danger to the performer or others.

*Process standards* generally are described in terms of sequence, completeness, accuracy, and/or speed of performance.

---

### Validating the job analysis data

Once task statements have been identified, written and categorized, validating the information is an important next step. In the validation process, job incumbents (and sometimes their supervisors) are asked two significant questions:

- Of all the tasks that you do, how do you rate this task according to its **difficulty, importance** (consequence of doing it wrong), and **frequency (DIF)**?
  - Has anything been left out?
- 

### Validation methods

There are many methods for this verification process, each with its own set of advantages and limitations. The one chosen will depend on time, resources and availability of workers. Among these data gathering methods and tools are:

- Interview
- Focus Group
- Observation
- Flowcharting
- Questionnaire—Surveys

The surveys are the method most often used, followed by a focus group.

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*Continued on next page*

## Job Analysis, Continued

### Difficulty, importance, frequency (DIF) survey and ratings

In a job (DIF) survey, incumbents are asked about their job position, length of time in the position, education, and areas of special experience. Instructions for how to complete the survey and a description of each rating level is provided. The ratings are generally on a five point scale.

### Importance table

*Importance* refers to how critical the task is compared to other tasks. Stated another way, what are the consequences of doing it wrong?

Rating	Importance (Criticality)
1	Minimal Value
2	Moderate Value
3	Needs to be done
4	Important
5	Critical

### Examples

TASK: *Negotiate a contract.* Importance: 5  
 TASK: *Complete a purchase order.* Importance: 3  
 TASK: *Make a copy on copier machine.* Importance: 1

### Difficulty table

*Difficulty* refers to how difficult this tasks is to perform compared to other tasks done by this worker. Note: Sometimes a distinction is made between *difficult to learn* and *difficult to perform*.

Rating	Difficulty
1	Among the easiest
2	Easy
3	Average or Minimally difficult
4	Difficult
5	Most difficult

### Examples

TASK: Conduct a source selection Difficulty: 4  
 TASK: Perform the negotiation process Difficulty: 2

*Continued on next page*

## Job Analysis, Continued

**Frequency table**      Frequency refers to how often the task is performed.

Rating	Frequency
1	Rarely (once a year or less)
2	Seldom (about three or four times a year)
3	Occasionally (about once a month)
4	Often (about once a week)
5	Very often (daily)

**Examples**      TASK: Identify specific elements on a contract.      Frequency: 5

**Decision tables**      The decision table shown below illustrates one way to sort the ratings and provide recommendations for the next step.

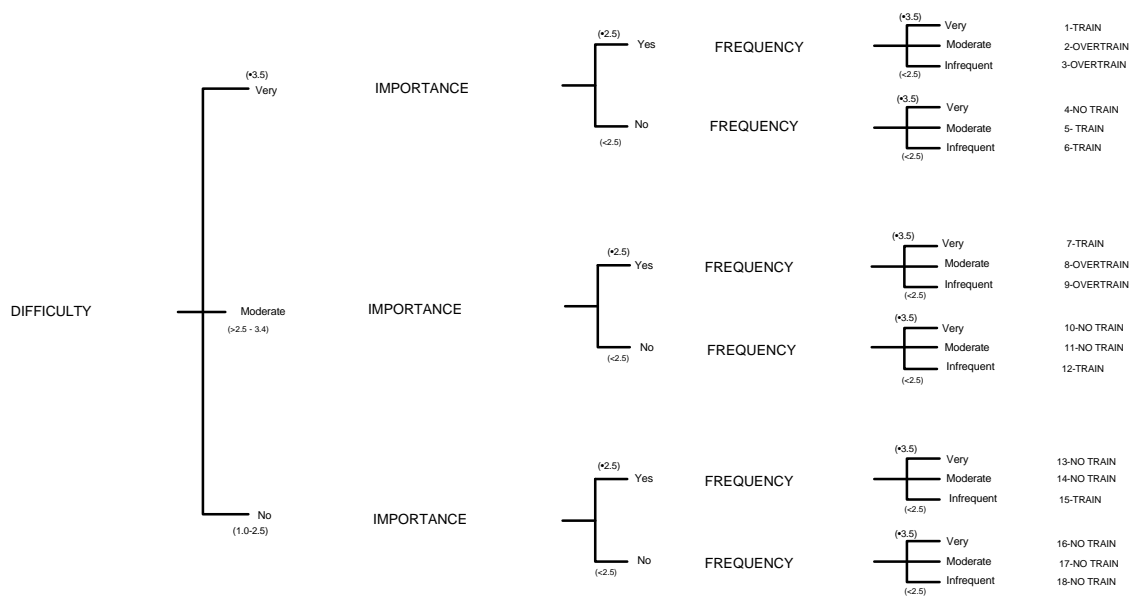
If the value of the task for . . .	Then . . .
importance is a 2 or less	do not consider any type of training intervention.
importance is a 3 or more	go to difficulty.
difficulty is a 2 or less	while the task needs to be done, workers will learn the task from others already on the job; no formal training will be developed or training dollars spent.
difficulty is 3 or more	determine if learning will occur via a job aid, formal initial training, or initial and continuing training.

*Continued on next page*

## Job Analysis, Continued

### Decision trees

A decision tree is another method used to help sort the average DIF ratings and assist in determining which tasks are identified for initial instruction, continuing (refresher or over training) instruction, or no formal training.



## Task Analysis

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### Introduction

Once tasks have been selected for education or training, the next step is to analyze the individual tasks. This process is time consuming and difficult, but it is in this step where documentation of the task actions (elements or steps) and the abilities, skills, and knowledge required to perform the task are determined. This information is critical to the instructional development process. Without it, developers have no idea of what skills and knowledge students need for learning to take place. For example, you need to know basic algebra in order to successfully complete the DAU cost analysis course and have skills in performing basic computations.

---

### Documenting the task

The first step in documenting the task involves gathering data about the task itself. Data gathered about the task includes:

- Task title (Of major importance in the development of *terminal* [performance, learning] *objectives*)
  - Task conditions
  - Task standards
  - Average time to perform task
  - Initiating signal or cue
  - Terminal signal or cue
  - Tools and equipment
  - References
- 

### Task analysis procedure

The second step in task analysis requires the listing of procedures or steps a person would actually perform to successfully accomplish the task. These task actions are called *elements* and are useful for the developer in the writing of *enabling objectives*.

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*Continued on next page*



## Task Analysis, Continued

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### Determining abilities, knowledge, and skills

The third step in analysis is to identify abilities knowledge, and skills required to perform a task.

- Ability, sometimes referred to as aptitude is a person's capacity to acquire skills and knowledge. Some examples:
  - *Verbal Comprehension* - to understand the meaning of words and their relationship to each other; to readily comprehend what is read.
  - *Verbal Fluency* - to be fluent in naming or making words.
  - *Numbers* - to be speedy and accurate in making simple arithmetic computations such as adding, subtracting, multiplying, and dividing.

Space, memory, perceptive speed, inductive reasoning and physical attributes are additional examples.

- Knowledge is the range of information or understanding of a subject or a variety of subjects. It includes items on information required to comprehend, recognize, and recall principles, rules, concepts, phenomena, symbology, and terminology. Knowledge is viewed as the combined result of formal education, training, and experience.
- Skills are the application or use of one's knowledge in a practical situation. Skills generally result from a combination of basic abilities and their augmentation by formal training and practical experience. Skills are acquired through training and practice and usually denote competence in doing or performing specific **physical** and **mental** jobs.

These skills and knowledge are the specific points of information that will be included in the content of the training and are called **learning points**. Identifying the steps (actions) in performing the tasks gives us the elements. Identifying what a person must do (skill) or must know (knowledge) to perform each step helps the developer distinguish between what students need to know and what is nice to know.

Remember, the purpose of conducting the task analysis is to establish a manageable foundation to build the training program/project.

---

## Content/Instructional Analysis

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### Introduction

A content analysis (also known as an instructional or learning analysis) is the process by which a designer/developer looks at the skills and knowledge (learning points) required in learning the task to create the opportunities for student learning.

---

### Steps in performing a content analysis

The following steps are included in a content analysis:.

Step	Action
1	Identify the type of learning required for mastery
2	Determine if the skill and knowledge learning points should be taught to the <i>use</i> or <i>remember</i> level.
3	Based on this information determine the <i>covert mental operations</i> of the learner

---

### Step one

The first step is to identify the type of learning required to master the content identified in a task analysis and decide what type of content the learning point is. The different types are:

- Fact
- Concept
- Procedure
- Process
- Principle.

This is of major importance if the task is more *cognitive* (mental) rather than *behavioral* (observable).

---

### Facts

A fact is a one-of-a-kind piece of information. It can be a singular fact (e.g., proper name - Naval Center for Acquisition Training) or fact statement (e.g., date associated with event—NCAT was founded in 1985).

Some examples of ***non-facts***: How to develop a statement of work (procedure), contracts (concept), value added (principle), Phases of Risk Management (process).

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## Content/Instructional Analysis, Continued

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### Concepts

A concept is a term which refers to a group of objects, events or symbols which share common attributes or features and are identified by the same name. When presenting concepts, all critical attributes of the concept must be presented so that students can distinguish all future examples from non-examples.

- Example: Acquisition Training: A structured opportunity for learning which includes stimulus response and feedback.
  - Some *non-examples*: The area code for Norfolk, VA (fact); How an automobile works (*process*); How to change a flat tire (*procedure*); Stand when saying the pledge (*principle*).
- 

### Procedures

A procedure is an ordered sequence of steps necessary to accomplish some goal, solve a class of problems, or produce some product that can (usually) be accomplished by one person.

- Examples: Using a calling card, place an overseas long distance telephone call; Check and add, if necessary, oil to your automobile.
  - Non-examples: How food is digested; How a motor works [These are events that are not actually performed by a person and are called *processes*.].
- 

### Processes

A process is an ordered sequence of events necessary to reach a goal which is accomplished by **more than one individual, department, organization, component or subsystem**. A process is achieved outside the control of any one person.

The difference between procedures and processes is a procedure describes steps which are performed (first *you* do this, then *you* do that...), while a process describes events or phases in a cycle that are not described in terms of performance (first *it* does that, then *it* does that...).

*Example:*

- How to terminate a contract (procedure);
  - How a contract is terminated (process).
-

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## Content/Instructional Analysis, Continued

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### Principles

A principle is a statement of cause and effect relationships allowing one to make predictions about some natural or behavioral action. A principle states what should be done (policies, rules), what seems to be true in light of the evidence (generalizations, theories, hypotheses), or what is unprovable but implied by other statements (assumptions).

Examples:

Smoking in a non-smoking building (policy); Ignoring a temper tantrum of an adult will reduce this behavior (generalization);

To find the area of a rectangle, use the equation  $A = \text{length} \times \text{width}$  (law).

---

### Step two

The second step in the content analysis is to match the information and instruction to a specific performance level. The content, as noted above, can be facts, concepts, processes, procedures, or principles. The performance outcome can be one of two levels: **Remember** or **Use**.

---

### Remember

The performance *remember* (knowledge) would ask learners to memorize, recall or recognize information that has not be applied in any way.

Example: “List the way to log on to the network computer system and access the word processing application ‘Word’. This task would require learners to memorize the steps, however, it does not guarantee that the learner could actually access “Word.”

---

### Use

The performance *use* (skill) asks learners to apply the information that has been memorized to some real world task. An example: Access the word processing software, ‘Word’ on the network computer system.

**Note:** Facts, concepts, processes, procedures, or principles may be at the **remember** or **use** performance level.

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## **Content/Instructional Analysis, Continued**

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### **Step three**

The final step is for the designer/developer to look at the information the learner must process and the sequence of cognitive operations required to make decisions, solve problems, or process information. The purpose is to represent the covert mental operations of the learner while performing a task, rather than modeling the overt behavior exhibited by the learner.

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## Summary and References

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### Summary

There are many variations to the Job and Task Analysis process. However, the purpose of analysis is to identify content so that meaningful, appropriate and performance-based training can be developed. Regardless of the approach, method, or type of analysis, without a proper and detailed one, meaningful and measurable objectives cannot be written, appropriate content cannot be developed, and performance related outcomes will not be achieved. Much time, energy, and money will have been wasted.

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## Section IV

### Design

#### Overview

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##### Introduction

The second step in the systematic approach to training (ISD) is design. Design is the “big picture” and is the process of using data accumulated during the analysis phase to specify where and how the tasks selected for training are presented in the training program. The purpose is to create a blueprint of the training program.

During this phase, learning objectives are written and sequenced, assessment items are constructed, and the “big picture” instructional setting, media, and instructional strategy are selected.

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##### In this section

The following topics are covered in this section.

Topics	See Page
Learning Objectives	4–2
Design Concepts	4–6
Performance and Assessment	4–7
Instructional Strategies and Methodologies	4–10
Section Summary and References	4–20

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## Learning Objectives

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### Introduction

For every education or training program, and for each course and lesson within that program, there is a set of intended outcomes. These outcomes are statements of what the learners should be able to do as a result of the instruction. The outcomes expected from a course or lesson are known as learning objectives, and serve three main functions. They:

- define the desired outcomes of learning
- serve as a guide to the selection of strategies and methods of instruction, and
- provide criteria for evaluation of the learning.

Thus, learning objectives play a crucial role in the planning and implementation of instruction.

---

### Preparing learning objectives

Learning objectives serve as the basis for performance-based education and training programs. In general, they are derived from skill and knowledge requirements identified during a task analysis and fall into two distinct categories: terminal and enabling objectives.

**Note:** Objectives are also known as performance outcomes, performance objectives, learning objectives, or behavioral objectives. Each of these names is really referring to the desired outcome of instruction.

A more detailed discussion on writing course objectives provided in Appendix C: Writing Learning Objectives

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### Terminal objectives

Terminal objectives [terminal performance objectives] are the identified desired learning outcomes after a segment of instruction. This segment could be an entire course or a lesson or module. Terminal objectives are frequently translated directly from task statements and clearly state the after-instruction performance the learner must be able to demonstrate.

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## Learning Objectives, Continued

### Enabling objectives

Enabling objectives provide the means for reaching the terminal objectives and generally consist of the skills, knowledge, and task steps that must be completed or satisfied in order to master the terminal objective. Enabling objectives are derived from the elements, skill, knowledge requirements identified during task analysis.

### Components of objectives

To describe the desired performance outcomes clearly, an objective should always address three questions:

Question	Meaning	Examples
Under what circumstances do you want the learner to perform the objective? What is available or supplied?	Condition	Given a simplified acquisition request... Given a copy of Procedure 5003.... Given a scenario... From memory (implied)...
What should the learner be able to do at the end of instruction?	Performance (Action Verb + Object of that action)	Identify acquisition life cycle phase... List the five phases of ISD...
How well must the objective be performed?	Standard	...within one hour. ...in accordance with procedure. Correctly or completely (implied)

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## Learning Objectives, Continued

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### Levels of objectives

The taxonomic level of each behavioral term listed in the chart which follows has been decided somewhat arbitrarily. Many of the terms may be classified at two or more levels depending upon the **context** in which the term appears.

These six levels however, provide a system for classifying objectives by moving from simple recall to complex evaluation. Each level has inputs from lower levels and provides output to higher ones. The first three levels — knowledge, comprehension, application—provide the basic information needed during normal performance. The last three levels—analysis, synthesis, evaluation -- address the higher levels of thinking required to perform during uncertain, unusual, abnormal, or emergency situations.

Regardless of the level of a course [100, 200, or 300 or numbered DAU courses], **it may have objectives ranging through all six levels.**

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## Learning Objectives, Continued

**Cognitive levels** Six cognitive levels are generally recognized when sequencing objectives:

Learning Level	Definition	Associated Action Verbs	Test Format
Knowledge	Recalling of specific bits of information: no comprehension required; memorization	Define Match Repeat Underline Name Label List State Recall Identify	Completion True/False Short Answer Multiple Choice
Comprehension	Understanding the meaning of material without application	Classify Identify Describe Explain Compare and Contrast	Multiple Choice Completion Matching Labeling Restricted Essay
Application	Using methods, concepts, principles, and theories in new situations (Rule governed thinking)	Apply Construct Calculate Modify Show Demonstrate Operate Solve Choose Distinguish Use	Multiple Choice Completion Matching Drawing Restricted Essay
Analysis	Breaking down information into its constitute elements	Analyze Examine Resolve Relate Classify Breakdown	Multiple Choice Essay Practical Exercise
Synthesis	Putting together new constitute elements or parts to form an original result	Derive, Generate Plan, Design Develop Formulate Create Organize	Multiple Choice (MC) Essay Practical Exercise
Evaluation	Judging the value; applying standards	Assess Defend Judge Criticize Justify	MC, Essay Practical Exercise

## Design Concepts

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### Levels of design defined

Curriculum design generally uses the following terms:

Term	Means
Program	The full set of activities to train or educate a particular group for a defined career position or a broadly related skill and knowledge area
Course	A component of a program to train in a major topic or duty area
Lesson, unit or module	A segment of instruction devoted to a particular task or topic
Activity	Learning experiences that support the teaching of enabling objectives

---

### Relationship between analysis and curriculum design

The following table compares performance of the **analysis** of jobs and tasks to **designing** program structure and sequence and **developing** the materials for the education or training program.

Analysis	Design/Development
JOB: Specific titles, what one earns \$ (money) doing	Training Program or Curriculum Plan
DUTY AREA: Common group of job responsibilities	Courses in the Program
TASKS: Job requirements in terms of performance, conditions, standards	Lesson (Units, Modules) with Terminal Objectives, Lesson Plans, Teaching Units
TASK ELEMENTS: Major steps (actions) in doing the task	Performance Measures, Practical Exercises, Teaching Points
SKILLS and KNOWLEDGE: What the learner must know and do for each element of the task	Enabling Objectives, Content, Teaching Points

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## Performance and Assessment

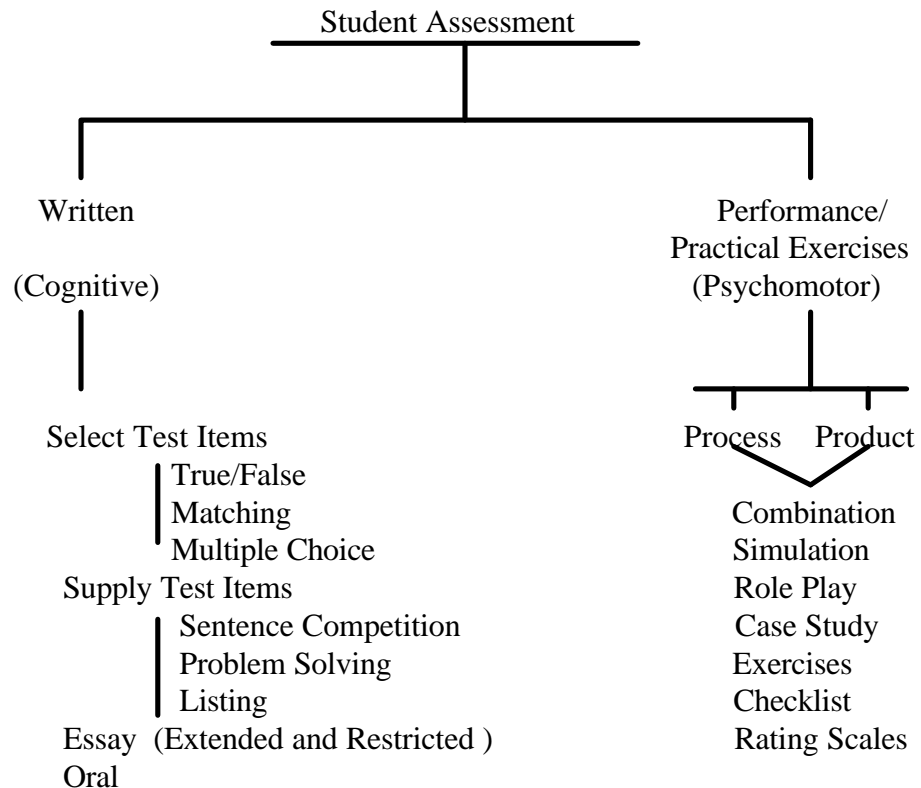
### Performance assessment

Information about learner performance—what skills and knowledge can be used to acquired, and how those skills and knowledges can be used to provide high quality instruction. Students' performance might be assessed at any time. This is to ensure that students have achieved the learning objectives, mastered the technical content, and should be an on going part of the instruction.

There are a number of ways to assess student performance. In some cases, an *informal assessment* might be a short oral quiz or having students provide brief written answers. A final course examination would involve a full-blown, *formal* written test.

### The nature of performance

Broadly speaking, there are two main categories of performance based assessments-cognitive and psychomotor. The diagram below depicts the types of assessment associated with each.



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## Performance and Assessment, Continued

### Written vs. performance test

The chart below compares written tests with performance/practical tests.

Written Tests	Performance/Practical Tests
Indirect measurement --select or supply type test items	Direct measurement -- simulation, role play type exercises
Measures mental behavior	Measures mental and physical behavior
Gathers scores about an individual	Gather data about an individual or group
Can be norm-referenced or criterion-referenced	Can be norm-referenced or criterion-referenced
Helps make educational decisions	Helps make educational decisions
Validity and Reliability important (mostly reliability)	Validity and Reliability important (mostly validity)
Isolation of mental aspects of a job task	Simulation of job task--a matter of degree
Limited forms of written tests	Can take on a variety of forms-- role play, demonstration, produce a product (e.g. report)--can be process, product or both
Product or process evaluated (mostly product)	Product or process evaluated (mostly product)

### Written test

Written tests are most effective in measuring the extent of cognitive learning. A written test can accurately tell how much a learner can recall, list, describe, compare, contrast, calculate, etc. It may be important to ascertain this. The learner may need to apply that information in simulated (or real) job or role situations. Non-written tests are most effective when the job or role situations are simulated in a training environment. Here the learner applies the learning material in simulating actual job or role performance.

The purpose of written tests is to measure the learning of individual participants. Such measurement is needed in order to provide information on whether the individual has the skills and knowledge to perform the job or role covered by the training. Tests are developed after development of the program, course, unit, and lesson objectives.

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## Performance and Assessment, Continued

### Criterion- and norm-referenced testing

There are two basic kinds of testing, *norm-referenced* and *criterion-referenced testing*. *Norm-referenced testing* involves comparing participants with each other or with other groups. Norm-referenced testing can be useful for testing large numbers of participants when average scores and relative rankings are important. The disadvantage of this type of testing is that even your top-ranking learners may not be able to perform required tasks adequately—they are only better than those ranking below them.

*Criterion-referenced testing* determines the students' degree of learning as measured against carefully written objectives and a predetermined cutoff score. It measures, reports, and analyzes participants' performance in terms of present learning objectives. Criterion-referenced testing is objective-based, precise, and easy to administer. It requires the development and use clearly defined objectives that can be measured.

### Test qualities

The test must be **valid**. Validity is the extent to which a test measures what it is supposed to measure. *Content validity* is directly concerned with the extent that the test measures the learner's achievement of learning objectives.

The test should also be **reliable**. *Reliability* is the consistency with which a test measures achievement. There are three factors that have a great effect on test reliability:

- *subjectivity of the scoring* (two or more evaluators should evaluate using the same criteria);
- *equivalent forms* (two or more versions of the test should measure the same set of skills and knowledge;
- *every administration of the test* (interoccasional reliability) should be similar in terms of time allotment, physical conditions, directions, etc.



## Instructional Strategies and Methodologies

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**Training setting**      Training setting is usually defined in the terms of:

Location	Definition
Classroom	An area typically arranged to present information to a group; usually furnished with chairs and tables, an instructor(s), and other equipment required to present information in an efficient manner.
Self-study	An approach and an area arranged to provide space for learners to study materials presented in the classroom or independent of formal classroom instruction.
Laboratory	An area typically containing equipment and materials to allow for the hands-on practice of specific skills. A computer classroom can be classified as a laboratory setting.
On-the-job - Employee Workspace	The work environment of the employee. The specific work space (desk) for Internet, Intranet, and CD-ROM training interventions.
Simulator	A training setting, computer controlled and programmed to replicate the operation of a process or piece of equipment (e.g. flight simulator).

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**Training format definitions**      Training format generally is described as:

Format	Definition
Instructor Led Discussion	The presentation of instructional material generally in the classroom setting, with emphasis on interaction between instructor and students.
Instructor Led Workshop	The presentation of instructional material generally in the classroom setting with emphasis on demonstration of tools, equipment, processes and products. Students generally follow up with hands-on practice as applicable.

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## Instructional Strategies and Methodologies, Continued

**Media definitions** Media for course support is typically identified as:

<b>Media</b>	<b>Definition</b>
Print-based	Materials which contain written and pictorial information presented in the form of handouts, texts, procedures, and reference materials.
Computer	Materials similar to print-based materials but which are presented on the computer. They are often interactive and or utilize simulation. Can be presented on CD-ROM, Internet or Intranet.
Interactive Video/disc	Systems that employ video and computers to create an interactive learning experience.
Video	Material which is used to present moving images and accompanying sound.
Transparencies and Slides	Material which is particularly effective in showing charts, diagrams, components, and schematics. Also used as a focus of attention to support an instructor-led presentation.
Audio-tapes	Material which is particularly effect when combined with slides or other pictorial material to show and explain specific equipment, conditions, or location.
Two-way video Two-way audio	Distance learning method using audio and video images exchanged between two or more locations.
One-way video teletraining	Distance learning method using audio conferencing between two or more satellite receiving sites, combined with video signals from the sending facility.

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## Instructional Strategies and Methodologies, Continued

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**Instructional strategies**

There are several strategies for delivering instructions and these include but are not limited to:

- lecture
- demonstration
- performance
- discussion
- independent study
- computer-based training (CBT)
- peer training
- simulation
- case studies
- practical exercises
- reading assignments

Each are described in detail below.

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**Lecture**

Lecture is a discourse given before a class or an audience for instructional purposes.

<b>Applications</b>	<b>Qualifications</b>	<b>Guidelines for use</b>
Use in the early stages of learning.	This method limits student participation.	Prepare an outline or plan in advance.
Use in a formal course or field training.	The lecture becomes a “telling session” for the instructor.	Organize the material into meaningful topics to promote understanding.
Use if time is short and many ideas must be presented.	Checking student learning prior to testing is difficult.	Use visual aids to express abstract concepts or show relationships.
Use if the number of instructors is limited and an instructor is responsible for a large number of students.	Student attention and interest may wander.	Allow time for a question-and-answer period to clarify points of confusion.
Use with all types or courses.		

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## Instructional Strategies and Methodologies, Continued

**Demonstration** A demonstration is an accurate portrayal of the precise actions necessary to perform skills or processes.

Applications	Qualifications	Guidelines for Use
<p>Use in an on-the-job course, a formal course, or field training.</p> <p>Most useful in teaching motor skills, simple manual skills or processes, and foreign languages.</p> <p>Use to set the standard of performance.</p> <p>Use to focus attention on basic procedures.</p> <p>Use to provide overviews or set goals of instruction.</p>	<p>The demonstrator must be a skilled performer who is able to verbally explain each step being demonstrated. This may require many hours of practice.</p> <p>Since the learner does not perform during a demonstration, you cannot evaluate the student's learning except through questioning.</p>	<p>Have an expert perform demonstrations using actual equipment or apparatus the student uses on the job.</p> <p>Simultaneously provide a simple explanation of the ongoing procedure as it is being performed.</p> <p>Tell the "why" as well as what is being done. Point out critical aspects of the procedure.</p> <p>Repeat demonstrations of complex operations.</p> <p>Immediately follow the demonstration with supervised practice. If immediate practice is not feasible, ask the learner to describe the performance or process verbally.</p>

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## Instructional Strategies and Methodologies, Continued

### Performance

In a performance the student practices, performs, and applies, under controlled conditions and close supervision, the skills or knowledge that have previously been explained and demonstrated.

Applications	Qualifications	Guidelines for Use
Use in the intermediate and final stages of learning.	This method is time-consuming because students must be given the opportunity to practice until they reach proficiency.	Provide explicit instructions for the learner to follow when practicing.
Use in an on-the-job course, a formal course or field training.		Provide safety precautions for the protection of the learner and the equipment.
Use to permit the student to apply learning to actual situations.	This method may require special facilities and equipment, which can be expensive and difficult to obtain. Once obtained, equipment must be constantly maintained.	Set up realistic work problems.
Use to allow practice with job-similar conditions, under supervision and guidance.	This method usually requires a higher student-instructor ratio than other methods of instruction.	
For verbal learning, problem solving, or rule using performance may take the form of recitation or a written report.		

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## Instructional Strategies and Methodologies, Continued

### Discussion

In a discussion there is interaction between learners and/or an instructor in order to analyze, explore, and/or debate an issue, topic or problem.

Applications	Qualifications	Guidelines for Use
Use in the intermediate and final stages of learning.	This method is time-consuming and can only be used with groups of limited size.	Know the subject matter to be discussed.
Use in a formal course or field training.	This method requires that participant have sufficient background so that they can talk about the subject.	Verbally outline the specific problem or issue and provide a case study of the situation to be read prior to the discussion.
Use as an extension of existing knowledge or to clarify and amplify familiar material.	Group discussions should be avoided in the early stages of learning when new material is being introduced; students are new and inexperienced in the topic area.	Call upon individuals to clarify, analyze, and summarize.
Use when students must learn to identify and solve problems and to frame their own decisions.		Guide the discussion; do not lecture!
Use when students need to be exposed to a variety of approaches, interpretations, and personalities.		Be patient with the group's slow progress toward understanding.
Use when teamwork is needed.		Be alert to the group's tendency to wander.

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## Instructional Strategies and Methodologies, Continued

### Independent study

Independent study is assigned readings or research that the student undertakes on his or her own without special guidance or instruction.

Applications	Qualifications	Guidelines for Use
<p>Use in the final stage of learning.</p> <p>Use with all types of courses.</p> <p>Use as an adjunct to other strategies of instruction.</p> <p>Use to improve an individual's present job performance.</p> <p>Use to prepare an individual for promotion.</p> <p>Use to allow a student to pursue a special interest not shared by other students.</p> <p>Use to transmit information only.</p>	<p>The student must be capable of setting his or her own goals and arriving at a means of achieving them.</p>	<p>Provide the student with a reading list tailored to his or her special needs.</p> <p>Provide the student with a statement of objectives that specify what he or she will be expected to accomplish.</p> <p>Devise a means of evaluating learning—example, written or oral test, performance tests.</p>

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## Instructional Strategies and Methodologies, Continued

### Computer-based training (CBT)

Computer-based training is instructional materials are prepared specifically to employ computer-based techniques. Small steps are carefully sequenced and cued to reduce errors, immediate feedback, and freedom on the part of the learner to vary the rate of learning.

Applications	Qualifications	Guidelines for Use
Use in all stages of learning.	Once developed, CBT materials are difficult to change unless a template approach is used.	Be sure the student has all the material, equipment, or devices needed to complete the program.
Use with a formal course or field training.		
Use to accommodate individual differences in rate of learning.	Development cost is high but delivery cost is low.	Be sure the student understands that the program is not a test. Responses made during the program are to help him/her learn and not to provide a basis for grading.
Use if scheduling is a problem, since students may work through materials when convenient.	Some students using standalone CBT object to the lack of social interaction.	Be available to provide assistance with any areas of the program with which the students has difficulty.
Use to improve uniformity of instruction. Also, all students may progress through the same material. It may be the sole source of instruction or may supplement other methods of instruction.		Periodically check the learners' progress to make sure they are learning.

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## Instructional Strategies and Methodologies, Continued

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**Peer training**

In peer training a student who has completed training acts as an instructor for another student. (During teaching, the student instructor may use any one or more of the several strategies presented in this appendix, such as lecture or demonstration.) Upon reaching proficiency, the trainee then instructs other students in the skills or processes to be learned.

Applications	Qualifications	Guidelines for Use
<p>During all stages of learning, this method provides a one-to-one instructor- learner relationship by using students to instruct other students. A student watches an expert doing his/her work, gets on-to-one tutoring in the same work unit, and upon attaining proficiency, performs the newly learned task for the next student and instructs him/her in the work unit.</p> <p>Use in an on-the-job course, formal course, or field training.</p>	<p>Instruction should be spot-checked in order to maintain quality control.</p>	<p>Initially, the student watches as an advanced student performs all job duties under supervision.</p> <p>After familiarization, the learner is instructed in the skills necessary to perform the job by the student whose job performance he/she watched.</p> <p>Upon passing all proficiency tests, the learner becomes the instructor of a third student.</p>

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## Instructional Strategies and Methodologies, Continued

### Simulation

Simulation is a representation of some aspects of reality (either a process, event or hardware/software) by symbols or devices that can be manipulated more readily than their actual counterparts.

Applications	Qualifications	Guidelines for Use
<p>Use in all stages of learning.</p> <p>Use in a formal course or field training.</p> <p>Use to illustrate analogous circumstances.</p> <p>Use to allow practice and feedback under low risk circumstances.</p> <p>May be programmed to work as a self-instructional device.</p> <p>Allows hands-on learning rather than more indirect forms of learning.</p>	<p>Development costs may be high, and the development process may be time-consuming.</p> <p>Special facilities and equipment may be expensive and difficult to obtain, equipment must be constantly maintained.</p> <p>This method usually requires a higher student-instructor ratio than other strategies.</p>	<p>During the early stages of learning, a low degree of realism is required. The student is merely expected to learn nomenclature, identify locations of objects, identify properties of objects, identify appropriate actions for a given situation, and so on.</p> <p>During the intermediate stages of learning, moderate degrees of realism are required. The student is expected to perceive information in larger blocks or patterns and begin to coordinate skills.</p> <p>During the final stages of learning, a high degree of realism is required. The student is expected to perform as he/she should on the job.</p>

## Section Summary and References

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### Summary

In the design phase of ISD learning objectives are written and sequenced, assessment items are constructed, and some major decision about the instructional intervention are made. Objectives, which are based on our analysis data, are the foundation for the instructional design and development. This section covered both terminal and enabling objectives, their three component parts, the six cognitive levels of objectives, and how to sequence objectives.

Objectives also provide a direct link to learner assessment which will confirm if learners have achieved instructional objectives.

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## Section V

### Development and Implementation (Delivery Methods)

#### Overview

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##### Introduction

During the development and implementation phase of the Instructional System Development process the details of course and lesson content are determined and student learning activities and support materials produced, and delivery methods decided. For classroom instruction, the Lesson Plan or Instructor Guide is the essential tool for effective instructional delivery.

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##### In this section

The following topics are covered in this section.

Topics	See Page
Learning Methods, Media and Modes	5–2
Modes of Delivery	5–16
Technology-Based Learning	5–22
Structured Writing Style	5–24
Instructor Guide	5–25
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## Learning Methods, Media, and Modes

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### Introduction

An important part of instructing and learning has to do with the methods, media, and modes used in delivering the material. The rationale, especially as it relates to adult learners, is the way that concepts and skills are presented may have more impact on the learning process than their content.

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### Learning methods

The term instructional method is very familiar. It can be defined as a procedure or process used to attain an objective or series of objectives. Traditionally, most classroom instruction has been instructor-led. The instructor's role in the classroom placed him or her in control. Students had little control over what they learned, how they learned it, and how much time they spent. It became easy to develop instructional programs for the instructor rather than the student. A greater emphasis is now placed on students controlling learning situations.

Existing and emerging technologies, adult learning theories, and the inherently student-oriented performance-based educational designs are changing the emphasis from teacher-centered to learner-centered instructional methods. The learning method(s) used in course design are going to be very dependent upon the amount of control given students in the learning situation. For example, the lecture method is almost entirely instructor-controlled, while a simulation gives the greater degree of control to students. Learner-centered learning is illustrated below.

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### Instructor centered teaming

Instructor-Centered Learning	Learner-Centered Learning
<ul style="list-style-type: none"> <li>Dependence is on instructor</li> <li>High stimulus control by instructor                             <ul style="list-style-type: none"> <li>Information</li> <li>Knowledge</li> <li>Cognitive</li> <li>Intellectual</li> <li>Formal</li> <li>Passive learner role</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>Dependence is on self and others</li> <li>Low stimulus control by instructor                             <ul style="list-style-type: none"> <li>Behavior</li> <li>Attitudes</li> <li>Self-insight</li> <li>Experiential</li> <li>Informal</li> <li>Active learner role</li> </ul> </li> </ul>

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## Learning Methods, Media, and Modes, Continued

### Traditional vs accelerated learning methods

There are also interesting comparisons between traditional and accelerated learning methods. Accelerated learning methods allow students to:

- learn material faster
- remember it longer, and
- recall it more easily.

The two basic principles of accelerated learning are that:

- learning should be fun-not boring, threatening, or judgmental, and
- learning should be global involving the “whole student” on all levels
  - intellectually
  - emotionally
  - kinesthetically
  - consciously, and
  - subconsciously

The table below provides a comparison of traditional and accelerated methods.

Traditional Methods	Accelerated Methods
Data-intense Information stuffing Emphasis on data storage Rote memorization Manpower Emotionless Colorless Emphasis on correct response Inhibited, guarded Individualistic and judgmental Punishing Draining Somber and serious	Process-intense Information accessing Emphasis on data processing Thinking skills Mindpower Expressive Sensory evocative Free to “wobble” and grow Open, relaxed Collaborative and supportive Empowering Engerizing Playful and enjoyable

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## Learning Methods, Media, and Modes, Continued

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**Selecting methods** Selecting appropriate traditional or accelerated methods for instructing and learning can determine the success or failure in reaching desired learning outcomes. The type of method(s) used may also be affected by the media selected. The criteria for method development generally follows three broad principles. Truly effective instructing:

- has a general pattern of well-organized procedures
- stresses comprehension, and
- tends to be more direct than implicit.

The following are recommended steps for selecting the appropriate method of delivery.

Step	Action
1	Specify the goals (objectives) of the educational effort and ways in which success will be measured.
2	Assess each individual's proficiency. Assess learners prior knowledge.
3	Structure the learning situation to maximize the probability of learning while minimizing the likelihood of behavior that is incompatible with learning.

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## Learning Methods, Media, and Modes, Continued

**Learning methods: advantages & disadvantages**      The advantages and disadvantages of various instructional learning method are provided below.

Methods	Advantages	Disadvantages
<b>Reading Assignments</b> (written text)  Appropriateness <ul style="list-style-type: none"> <li>• Formal course</li> <li>• Homework assignments</li> <li>• Knowledge building</li> </ul>	Reaches large numbers of people with the same information.  Can be studied at times, conditions, and pace suitable to student (if outside classroom).  Represents a reasonably efficient way of learning.  Can be used to provide basic concepts before an activity or provide more in-depth information.  Provides flexibility in learning style (e.g., words and graphics).  Can be used as a reference after training.	Is expensive to duplicate and distribute.  Students read at different paces. Can be boring and isolating if overused.  Can alienate students who associate reading assignments with negative school experience.
<b>Lecture</b> (Oral presentation of material by instructor with or without question-and-answer session)  Appropriateness <ul style="list-style-type: none"> <li>• On-the-job instruction</li> <li>• Formal course</li> <li>• Audiotapes</li> </ul>	Reaches large number of people with the same information.  Provides familiar, direct, easy-to-use method.  Persuades students to accept a particular point of view.  Summarizes results of group activities.  Preparation is easier when compared to other methods.  Can be adapted to audience interests.	Little group participation; learning is passive. Students tend to remember less of what they hear.  Adequate delivery is highly dependent on instructor's presentation skills.  Tiring to group if long.

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## Learning Methods, Media, and Modes, Continued

### Learning methods: advantages & disadvantages, continued

This table is continued from the previous page.

Methods	Advantages	Disadvantages
<b>Demonstration</b> (Showing a process or procedure so that students can see action correctly carried out)  Appropriateness <ul style="list-style-type: none"> <li>• On-the-job instruction</li> <li>• Formal course</li> <li>• Knowledge/Skill building</li> </ul>	Illustrates application of theory or principles.  Tends to be a motivation enhancer.  Emphasizes and clarifies important procedures.  Tends to emphasize realism, true-to-life experiences.	Requires careful planning.  Danger of appearing artificial.
<b>Fields Trips</b> (Learners go to a site location and observe)	Reinforces points made in the classroom.  Provides firsthand experience.  Broadens perspective and understanding.  Can increase interest and enthusiasm.	Requires time and effort to arrange.  Requires careful planning.  Can be physically tiring.  Difficult to keep practical.  Can be disruptive to normal work operations.  Cost and resource intensive.

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## Learning Methods, Media, and Modes, Continued

### Learning methods: advantages & disadvantages, continued

This table is continued from the previous page.

Methods	Advantages	Disadvantages
<b>Discussion</b> (Information shared through student-teacher and teacher-student interaction)  Appropriateness <ul style="list-style-type: none"> <li>• Formal course</li> <li>• On-the-job instruction</li> </ul>	Reinforces acquiring and practicing knowledge states.  Allows students to use each other as resources.  Allows for exchange of ideas, views, and opinions.  Relieves instructor from being sole provider of information.  Makes lessons more flexible.  Can be used to assess the student's understanding of material.	Does not work if students are not knowledgeable.  Takes time.  Aimless/dominated discussions lose student interest.  Opens potential for interpersonal conflict.  Requires clear direction and focus.  Less opportunity for full participation if large group.
<b>Breakout Groups</b> (Small group of no more than 4 to 6 formed to conduct an activity)  Appropriateness <ul style="list-style-type: none"> <li>• Formal course</li> <li>• Knowledge/Skill building</li> <li>• Motivation</li> </ul>	Can be used to divide a problem into manageable tasks to be analyzed in small groups.  Provides situation for analyzing group process skills.  Allows learners to use each other as resources and to learn from one another.  Allows less assertive learners a chance to talk in a non-threatening situation.	Takes time.  Instructor cannot monitor all groups, so groups can get off track.  Difficulty with group dynamics; can create problems focusing on group task.  Compounded by group size.

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## Learning Methods, Media, and Modes, Continued

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**Learning  
methods:  
advantages &  
disadvantages,  
continued**

This table is continued from the previous page.

Methods	Advantages	Disadvantages
<b>Recall Exercise or Self-Evaluation</b> (Paper-pencil activities that help students acquire knowledge)  Appropriateness <ul style="list-style-type: none"><li>• Knowledge reinforcement</li><li>• Formal course</li><li>• Homework assignment</li></ul>	Allows learners to test their knowledge.  Gives learners feedback on how they are learning.  Helps learners focus on critical factors.  Tests knowledge and facts when this is a prerequisite to the objective.	Can appear to be “busy work.”  Can appear threatening, like a test.
<b>Practical Exercise</b>  Appropriateness <ul style="list-style-type: none"><li>• On-the-job instruction</li><li>• Formal course</li><li>• Skill building</li><li>• Motivation</li></ul>	Allows for practice of knowledge and performance.  Allows for practice of job behavior in a safe environment and enhances transfer of skills to real work situation.  Can be used with individual students and groups of students.	Can be confusing if student practices procedures not used on the job.

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## Learning Methods, Media, and Modes, Continued

**Learning  
methods:  
advantages &  
disadvantages,  
continued**

This table is continued from the previous page.

Methods	Advantages	Disadvantages
<b>Case Study</b> (A factual account of a real situation which students must analyze to determine the problem and alternative solutions)  Appropriateness <ul style="list-style-type: none"> <li>• Seminar</li> <li>• Formal course</li> <li>• Skill building</li> </ul>	Very motivating.  Highly participatory.  Simulates the way analytical skills are used on the job and enhances transfer.  Gives learners insight into their own habits of thinking, viewing, and interpreting.  Relieves instructor from being sole source of information.  Can be used to practice knowledge or performance.  Allows for flexibility; can be used individually or in groups, in self-paced or classroom situations.	Time consuming to conduct.  Requires careful preparation.  Apathetic or shy learners may not like to be actively involved.  Especially-interested students may dominate.  May require advance study by students.  May require certain level of prior knowledge.
<b>Critical Instance</b> (Miniature case study where students analyze a critical situation)  Appropriateness <ul style="list-style-type: none"> <li>• Seminar</li> <li>• Formal course</li> <li>• Skill building</li> </ul>	All learners apply knowledge to arrive at a solution.  Very motivating.  Gives less creative or slower learners a chance to learn from others and not have to perform alone.	Can appear artificial. Forced decision-making can create resentment.  Shy, less able students may not participate, letting others do the work.

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## Learning Methods, Media, and Modes, Continued

### Learning methods: advantages & disadvantages, continued

This table is continued from the previous page.

Methods	Advantages	Disadvantages
<b>Incident Process</b> (Problem which must be solved through questioning)  Appropriateness <ul style="list-style-type: none"> <li>• Seminar</li> <li>• Formal course</li> <li>• Skill building</li> </ul>	Develops probing and questioning skills.  Requires no advance study by students.  Pressure to decide on action can develop ability to reconcile differences.	Can seem artificial.  Requires skillful leadership.
<b>Role Play</b> (Student can “act out” a situation while others observe and analyze)  Appropriateness <ul style="list-style-type: none"> <li>• Seminar</li> <li>• Formal course</li> <li>• Skill building</li> <li>• Motivation</li> </ul>	Facilitates understanding and communication.  Allows learners to examine their attitudes and behavior.  Provides forum where students practice complex interpersonal skills in a relatively safe environment.  Reinforces practicing knowledge stage.  Allows participants to learn from each other’s comments.	May be fearful for shy/self-conscious students.  May be painful learning. Difficult to communicate results.  Requires skillful leadership.  May appear artificial. Requires mastery of knowledge first.
<b>Simulation</b> (Job conditions are duplicated and various practice sessions are set with a variety of variables)	Introduces factors that replicate on-the-job conditions.  Offers students the chance to try out the job before they do it.	Time consuming to conduct.  Requires careful preparation.  Can be costly.  May appear artificial.

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## Learning Methods, Media, and Modes, Continued

**Learning methods: advantages & disadvantages, continued**

This table is continued from the previous page.

Methods	Advantages	Disadvantages
<b>Performance Tests</b> (An exercise that requires the student to demonstrate job performance in a controlled environment)  Appropriateness <ul style="list-style-type: none"> <li>• OJT</li> <li>• Skill building</li> </ul>	Tests the performances practice stage.  Provides students the chance to practice on-the-job behavior with no penalty for mistakes.  Allows for specific feedback.	Can intimidate students.  Takes time to plan, implement, and provide specific feedback.
<b>In-Basket Exercise</b> (Pencil-paper simulation for jobs in which students are given a group of work papers and they take the appropriate action)	Provides practice in analyzing, setting priorities, problem-solving, and communicating.	Very detailed to construct.  All necessary information must be provided.
<b>Presentation By Students</b> (Students present their work verbally)  Appropriateness <ul style="list-style-type: none"> <li>• Seminar</li> <li>• Formal Course</li> <li>• Skill building</li> <li>• Motivation</li> </ul>	Can be highly motivating.  Develops presentation skills.  Allows for development and use of visual aids.  Students can learn to orally defend or rebut points of contention.	Can be intimidating to students who are apprehensive about talking in front of groups.  Time consuming.  Can be boring and/or repetitious.

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## Learning Methods, Media, and Modes, Continued

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### Media

Media are the means, instruments, or materials used to communicate information. Various mediums include print, visual, verbal/aural, verbal/visual, etc. The type of media selected must be appropriate to ensure that information to be learned is accomplished in the most effective and efficient ways. While there are all types of media, no single medium is appropriate for every learning situation.

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### Types of instructional media

There are at least nine specific type of instructional media used in education.

- Instructional objects, e.g., giving demonstration
- Social models, e.g., imitation and modeling
- Oral communication, e.g., teaching by telling, group interactions
- Printed language, e.g., textbooks, newspaper
- Pictures and diagrams, or graphic representations of real objects
- Motion pictures, which can represent a combination of demonstration and verbal communication
- Instructional television/videos: however, be careful, most educational films and videos fail to specify their instructional objectives
- Programmed instruction, materials that are programmed to specifically meet certain learning tasks
- Computer-aided instruction (CAI), or computer-based instruction (CBI) which has not yet realized its full potential but is typically viewed as superior to other mediums because it is more responsive and can engage a student's attention to a greater degree

**Note:** Drill or practice, tutorial systems, and dialogue-interaction are among the many potential uses for computers.

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## Learning Methods, Media, and Modes, Continued

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**Benefits**

There are at least four positive characteristics of educational media.

- Media can often catch a learner's interest and hold it.
  - Adults frequently learn from media with pleasure and enthusiasm.
  - Media can provide stimulation and information that would not be available any other way.
  - Media offer teachers the possibility of individualizing instruction.
- 

**Use of media**

Two major steps are involved in designing a learning program using media.

Step	Action
1	Clearly state learning objectives so that sequence and steps in the task are clear.
2	Given specific learning objectives, choose the appropriate combination of media.

A general description of selected media is provided on the following page. The list is merely illustrative and offers some advantages and disadvantages of selecting certain media.

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## Learning Methods, Media, and Modes, Continued

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**Media:** This chart lists the advantages and disadvantages of using certain media.  
**advantages/  
disadvantages**

Media	Advantages	Disadvantages
<b>Instructor</b> (Teacher/facilitator delivers information)	Allows for flexibility.  Can model desirable attitudes as well as convey information.	If instructor has poor presentation skills, very ineffective.  Must be supplemented with other media.
<b>Text, Printed Media</b> (Used for reading, handouts, forms, job aids)	Can be expensive.  Is easy to transport.  Is easy to duplicate.  Requires no equipment.	Does not show motion.  Can become boring.  Inappropriate for audiences who do not read well.  Is expensive.
<b>Flipchart</b> (Can be pre-lettered or blank; used to present and record information)	Can tear off pages and fasten elsewhere.  Can easily change.  Captures highlights of moment.  Use to record and display summary points.  Stimulates participation.	Not durable.  Sometimes not visible in large groups.

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## Learning Methods, Media, and Modes, Continued

**Media:**  
**advantages/  
disadvantages**

This chart lists the advantages and disadvantages of using certain media.

<b>Transparencies</b> (Overhead slides that can be pre-lettered or blank; used to present and record information)	Easy to revise.  Can be produced quickly.  Can be used in a lighted room.  Can face class when using.  Can use instead as notes.  Can use color.  Can write on in some cases.  Effective for demonstrating how to fill out forms.	Equipment is required.  Can be used as a “crutch” by the instructor.  Can be boring with overuse.  Sometimes not visible in larger groups.
<b>Film, Tapes, Slides, TV</b> (Off-the-shelf or created media products; used to inform or demonstrate)	Stimulates attention.  Appeals to visual/aural learners.  Effective for demonstrations.  Is usually transportable.	Equipment is required.  Can be expensive to produce.

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## Modes of Delivery

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<b>Introduction</b>	Modes are the format in which learning content will be delivered to the student. Modes are the ways in which we organize media. There are several modes of delivery which are verbally illustrated in the section below.
<b>Classroom</b>	<p>The classroom mode is a planned education and training program during which the student is guided to the achievement of objectives by the instructor and the course materials. The characteristics of the classroom mode are:</p> <ul style="list-style-type: none"><li>• Learning occurs in a formal classroom setting,</li><li>• All activities are led by an instructor,</li><li>• There is a structured sequence and time limit for completion of activities, and</li><li>• There is instructor-to-student and student-to-student interaction.</li></ul>
<b>Tutoring</b>	<p>Tutoring has traditionally been a less frequent mode of delivery, although performance-based education and training designs require the consideration of this mode of delivery as a possible remediation device. Essentially, it consists of a period of reading, or independent work, followed by a tutoring session. The tutor's function is four-fold:</p> <ul style="list-style-type: none"><li>• To stimulate the student's thinking by answering questions and discussing issues relevant to the reading</li><li>• To assess what the student has learned from the readings</li><li>• To provide feedback relative to the assessment</li><li>• To provide direction for future reading and study</li></ul> <p>This mode requires that the bulk of learning be performed by the learner, primarily through reading, and it presupposes a motivated, skillful, and mature learner who can function effectively in a self-directed manner.</p>

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## Modes of Delivery, Continued

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<b>Lecture</b>	The lecture mode consists of verbal communication from the instructor and is, most commonly used. Although common, its effectiveness has long been questioned because of the necessity for extremely good communication skills on the part of the instructor. An effective lecturer can inspire enthusiasm and motivate learners to achieve. However, irrespective of the quality of the speaker, the lecture format is not conducive to prompting and guiding learners, assessing the information gained or providing feedback. Thus, under close scrutiny, the lecture has limited instructional value.
<b>Recitation</b>	Recitation is a mode that simply has a class or individual recite what they have learned, and the instructor evaluates their performance and provides feedback. There are many variations using recitation (e.g., inquiry questioning, review sessions, etc.). Recitation is an appropriate mode of learning for the purposes it serves. The main limitation is that learning must have occurred for the recitation to function properly.
<b>Discussion</b>	The purpose of discussion in the classroom is to “take off” from a certain level of information and apply the learned principles in a variety of situations and contexts. The questioning techniques used by the instructor are intended not to elicit facts but rather to stimulate and generate questions and ideas. Discussion is concerned with the transferability of learning, and therefore it cannot (and should not) assume the role of teaching specific information or facts.
<b>Laboratory</b>	In a laboratory situation students learn information through exposure to and manipulation of real objects and events, or by testing hypotheses with actual materials. The laboratory mode is appropriate for a variety of subject areas and need not be tied to a specific physical location.

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## Modes of Delivery, Continued

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**Modes Compared** Which mode of delivery a course designer chooses will, of course, depend upon several variables. Regardless of the mode used, course designers need to be aware of the advantages and disadvantages of the three primary modes: classroom; self-instruction, and technology-based interventions.

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**Classroom:  
advantages/  
disadvantages**

The classroom mode has several advantages and disadvantages as described below

Advantages	Disadvantages
<ul style="list-style-type: none"><li>• Provides interaction between instructor-to-students and students-to-instructor.</li><li>• Provides structured learning activities.</li><li>• Provides opportunity to validate student's achievement of objectives.</li></ul>	<ul style="list-style-type: none"><li>• Requires classroom space.</li><li>• Requires students taking away from the job.</li><li>• Students may have a wait a long time for a course quota.</li><li>• Differences between instructors can cause inconsistency in content covered.</li><li>• Slow learners may be left behind; fast learners may be bored.</li><li>• Limited time to achieve objectives.</li></ul>

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## Modes of Delivery, Continued

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<b>Self-instruction</b>	<p>Self-instruction is defined as a planned training program conducted in a learning center, or other appropriate environment. The student learns through a series of self-administered activities without the aid of a full-time instructor or coach. The self-instruction mode offers the most potential in terms of developing remediation exercises, assessments, and computer-based instruction. The characteristics of self-instructional program are:</p> <ul style="list-style-type: none"><li>• It is self-administered, and all instructions are provided for the student,</li><li>• It provides feedback throughout the program,</li><li>• It is self-paced within established organizational guidelines,</li><li>• It contains extremely detailed content, as there is no instructor to explain or elaborate on content.</li></ul>
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## Modes of Delivery, Continued

**Self-instruction  
advantages/  
disadvantages**

The self-instruction mode has several advantages and disadvantages to consider as listed in the table below:

Advantages	Disadvantages
Portability—can be used anywhere any time that required equipment is available.	Requires the learner to take time away from the job, but not possibly less time than attending a class.
Flexibility—students can select alternate paths through material, work at their own pace, and take only those lessons relevant to their jobs (or remediation).	Revisions are more difficult. Must change all the materials instead of instructor announcing changes to class.
Cost reduction in travel and per diem—students can take training at their office.	Validation of materials takes longer; needs more tryouts.
Uniformity—can standardize information being taught.	Requires student initiative and self-discipline.
Consistency of quality—variations caused by differences in instructors are eliminated.	Students who need interaction to learn may find self-instruction difficult.
Students can begin training at any time, do not have to wait for class quotas.	
Development of independent learners—students learn how to complete learning activities according to their own schedule.	
Versatility—can be used in the classroom in conjunction with classroom activity.	

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## **Modes of Learning, Continued**

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**Homework**

Homework is not a word that students like to hear. Yet, homework is an important mode of self-instruction. Self-instruction can be used to learn prerequisite material, for recitation and discussion sessions, or it can be in the form of practicing previously studied material. If the task is within the capabilities of the learner, then the functions of self-instruction can be served. However, if the task is too difficult and (becomes frustrating), homework may be detrimental to the learning process.

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## Technology-Based Instruction

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### Introduction

Education and training have traditionally been delivered in a classroom setting. In the past, technology has been used to improve the quality of classroom delivery. Emerging technology allows for the delivery of courses over the World Wide Web or in a stand-alone mode using a CD-ROM. Advancements in computer technology now allow for the delivery of quality instruction in the learner's work setting. In those cases where classroom delivery is still best for ensuring learning, it can be delivered by the traditional "one-room classroom" or can reach larger audiences through video teletraining.

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### When to use Technology- Based Learning

Section 7, *Technology-Based Education and Training*, provides a detailed discussion on the subject. You may also visit the website. The URL is: <http://www.txdirect.net/users/jeturner/dauweb.htm>.

Technology-based learning can be used when the following applies:

- The learner needs to apply rules or perform a procedure to accomplish the task.
  - The task is interactive and the trainee needs feedback to go through the steps.
  - Animation will convey the concept more effectively than a static representation.
  - Many repetitions are needed so that the task can be accomplished automatically.
  - The task involves understanding processes that are not always visible in the actual equipment.
  - The task is so critical that it must be performed flawlessly every time.
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## Technology-Based Learning, Continued

### Advantages/ disadvantages

There are many advantages to Interactive Video-Disc (IVD), Distance Learning (IDL), and other Technology-Based Training (TBT) technologies.

Advantages	Disadvantages
Can be used independently at a trainee's own pace.	Learners may not have access to the equipment.
Permits repetition until content is mastered.	Instructors may perceive this media as less rigorous than traditional classroom instruction.
Provides immediate feedback.	Instructor workload may intensify.
Costs can be amortized over time.	Requires special equipment that organizations may not have.
Can be interactive; with IVD many sites can be reached at the same time.	
Permits learner to think through more than one solution to a problem.	
Can be used to manage instruction.	
Can be perceived as fun.	
Permits decentralized training.	

## Structured Writing Style

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<b>Introduction</b>	Structured writing style text or course mapping are currently the recommended format style for developing instructional products. The principle behind this formatting style is that all information should be grouped into small manageable “blocks” or “chunks” of information with each block covering one main point or idea.
<b>Grouping</b>	This grouping of text into blocks of focused information makes it easier for learners to clearly distinguish one main idea or point from another. This aids initial comprehension of material as well as later recall of the content.
<b>Naming blocks</b>	As information is grouped into blocks, a short description or title indicates the type of information it contains. As blocks of related information are grouped together, this organization is given a title or name.
<b>An example</b>	This document was written using a modified structured writing style or course mapping. Review some sample pages for a general idea on layout and formatting. The intent of structured writing is to be flexible and respond to the requirements of the purpose for the document. While the grouping, blocking, chunking, and formatting style pictured on these pages uses many of the structured writing style guidelines, its intent is to be descriptive rather than prescriptive.

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## Instructor Guide

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**Introduction**      DAU Policy Memorandum #1, *New Course Development, Revision, and Maintenance Process* outlines the requirements and contents of the instructor guide, student guide, and lesson plan. The policy memorandum also includes definitions of terms and how each are used. Policy memoranda may be viewed on the DAU web site at: <http://www.acq.osd.mil/dau>.

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**Instructor guide**      The instructor guide defines the content and instructional methodology for each unit of instruction. It includes descriptions on

- how the course is administered
- how materials are to be used, and
- how learners are to determine success.

The guide account for time spent in class and clearly prescribes parameters of the courses. The aim is to standardize delivery of the content without inhibiting academic freedom.

---

**Components of the guide**      The instructor guide contains, but is not limited to the following:

- Course outline and daily schedule
- Terminal and enabling learning objectives
- Guidance for administering the course, to include room set-up, homework requirements, testing procedures, and attendance policies, etc.
- Key teaching points
- Student assessments and standards for successful completion
- Reference material citations, including references to sources for student self-remediation
- Materials required such as training aids, and equipment.

An instructor guide is provided in Appendix F, Components of an Instructor Guide.

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## Development of Lesson Plans

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**Introduction** Lesson development involves compiling all the components of the lesson plan and student material. A teaching outline is developed using the documentation from analysis and design, incorporating strategies to aid learning. All additional student and teaching materials are assembled and finalized.

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**Definition** The Lesson Plan, provides consistency of content in lesson delivery. It is not intended to mandate methodology or restrict academic freedom. Its purpose is to allow for uniform content delivery among all instructors of a course. The course design plan is the blue print for specifications for the education and training to be developed. An example is provide in Appendix E, Components of a Design Plan.

The Lesson Plan documents:

- Learning Objectives
  - Lesson Content and Presentation Strategies
  - Instructor and Student Activities
  - Student Assessment and all Resources
- 

**Purpose and function** As noted, the major purpose of a lesson plan is to promote consistent delivery of the lesson content. The objectives are sequenced and the content is organized in the order of the lesson's presentation. The lesson plan serves as a guide to the *what* and *how* of lesson delivery.

- What—The actual content of the lesson
  - How—Guidance on the methods and strategies used for delivery
- 

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## Development of Lesson Plans, Continued

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**Steps in  
development**

The following actions are taken in the development of a lesson.

Step	Action
1	Research data to include analysis.
2	Prepare a course design plan.
3	Organize and develop lesson plan.
4	Select or create instructional support materials.
5	Submit for review and approval.
6	Pilot and revise.
7	Use in conducting training and maintain and revise.

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**Instructor  
preparation**

The following items are usually part of the instructor's preparation and are usually identified as the "cover" information.

- Title of the lesson
- Revision Number (if required)
- Time Required (length) to teach this lesson
- References
- Objectives (Terminal and Enabling)
- Instructional Aids, Media and Equipment
- Student Preparation and prerequisites
- Presentation Methods
- Evaluation Method
- Notes and other information that would be helpful to another instructor

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## Development of Lesson Plan, Continued

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**Instructor presentation**

The body of the lesson plan contains the following four sections:

<b>Section</b>	<b>Components</b>
1. Introduction	Attention gaining device, motivator, objectives (how will they be presented to students), and a tie to past learning.
2. Development	Content outline, activities, media, reviews and practice, questions for each enabling objective section
3. Application or Practice	Practice or application may have a separate section that would include group activities or exercises
4. Summary or Conclusion	Review objectives and main points, evaluation [if not part of Development Section or Practice Section], and point ahead to next lesson

**Example**

A lesson plan template is shown in Appendix F.

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## **Development of Student and Instructional Support Materials**

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<b>Student Guide</b>	The Student Guide is a reference resource to assist the student's learning experience during and after the course. It may be paper-based, on diskette, CD-ROM, the Internet, or a combination of the above.
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<b>Components of student guide</b>	A Student Workbook (text or manual) contains, but is not limited to, such items as:
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- Administrative information
  - Terminal and Enabling Objectives
  - Student assessment information
  - Written text/outline on topics covered in the course
  - Checklists, worksheets, job-aids for use during exercises, group activities and independent study
  - Directions for completing exercises and the exercise—questions, situations, data, role play descriptions, etc.
  - Answers to exercises if not reviewed in class
  - Additional references
- 

<b>An example</b>	An example of a section of a student guide is included as Appendix F.
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## Course Pilot

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<b>Purpose</b>	The purpose of a course pilot is to determine if the instructional materials are performing according to their design and development specification. In other words, did the materials accomplish the instructional and learner objectives.
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<b>DAU Guidance</b>	DAU Policy Memorandum #1, <i>New Course Development, Revision, and Maintenance</i> provides guidance relative to development of all course materials and a course pilot in conjunction and validation with mandated In-Process Reviews II and III.
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## Section Summary and References

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<b>Summary</b>	In this section the developmental phases of a systematic approach to education and training were discussed. One of the main purposes of the development phase is to create documents that help ensure consistent delivery of course content. Included in the discussion was an outline of methods, media, and modes of learning, a structured writing style, and the development and components that make up the Instructor's Guide (Course Outline), Topic Lesson Plans, and Student Materials. All of these materials are validated during an initial conduct of the course called a pilot.
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## Section Summary and References, Continued

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## Section VI

### Evaluation: Student Performance

#### Overview

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##### Introduction

Acquisition education and training reform efforts places greater emphasis on learner performance outcomes. As a result reform leaders are asking two fundamental questions: (1) How well are students learning? and (2) How effective is the instruction delivered. Both of these questions can be answered through effective test and assessment of classroom learning.

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##### Performance Objectives Are Critical

Good performance objectives are critical to the creation of sound learner test and assessment processes. Performance objectives play an important role in developing effective learner testing and/or assessment outcomes.

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##### Purposes of Performance Objectives

Well-written performance objectives serve three fundamental purposes for performance-based tests and assessments.

- *Objectives ensure that the assessment is directly related to desired learner outcomes.* This is an especially important consideration in performance-based learning because the content for assessments is derived from task or need analysis procedures that order objectives hierarchically. Matching test or assessment items to the appropriate course objectives within these hierarchies, guarantees that all essential content is assessed.
  - *Objectives increase the accuracy with which cognitive processes can be assessed.* A well-written objective becomes the blueprint for the creation of assessment items that measure the specific performance outcome described by the objective.
  - *The size of the domain covered by the objectives and the homogeneity of the objectives being assessed are important factors in determining the number of assessment items.*
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## Overview, Continued

### Curriculum designers

Curriculum designers need to evaluate the appropriateness of test and/or assessment items. Educational research reveals that many teachers teach at lower levels, but frequently test at the higher cognitive levels. In other instances, the exact opposite occurs; teachers teach at the higher levels, but test at low levels of cognition.

This emphasizes the need to match learning objectives and teaching activities with test or assessment items to determine whether or not they approximate the level described in the performance terminal or enabling objectives. Such activities form the measurement component of curriculum alignment. Thus, well-written performance objectives are the key to effective teaching and the construction of valid measures of learning.

### In this section

The following topics are covered in this section:

Topic	See Page
Applied Definitions	6–4
Types of Tests and Assessment Items	6–6
Guidelines For Selecting Assessment Techniques	6–8
Multiple-Choice Items	6–9
Alternative Choice Items	6–13
Matching Items	6–15
Completion/Fill-In Items	6–17
Extended Response Essay Items	6–18
Restricted Response/Short Answer Items	6–20
Case Study Items	6–21
Critical Incident Method	6–22
Incident Method	6–23
Practical Exercise Method	6–24
Simulation Method	6–25
Role Play Method	6–27

*Continued on next page*

## Overview, Continued

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**In this section,  
continued**

The following topics are covered in this section:

Item Analysis: Validity	28
Item Analysis: Reliability	33
Deciding How Many Test Items	37
Summary	40
Section References and Suggested Readings	41

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## Applied Definitions

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### Introduction

Learner performance may not always be measured numerically. Different approaches to measurement are frequently confusing and need to be defined. There are four terms that are used interchangeably.

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### Applied definitions

The table below makes the distinction among them.

Term	Definition
Testing	is the collection of quantitative (numerical) information about the degree to which a competency or ability is present in the test taker. There are right and wrong answers to the items on the test, whether the test is comprised of multiple choice or written questions of a performance test requiring the demonstration of a skill.
Assessment	is a systematic information collection without reference to making judgments of worth. It may involve the collection of qualitative (narrative) as well as quantitative information. Assessments are usually made by building a profile of something using a series of qualitative and quantitative inputs; e.g., successful learning.

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## Applied Definitions, Continued

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### Applied Definitions, continued

The applied definitions are continued here.

Term	Definition
Measurement	This is the collection of quantitative data to determine the degree of whatever is being measured. There <i>may not</i> be right or wrong answers. A measurement inventory (e.g., of learning styles) might be used to determine a preference for using a systematic style versus a spontaneous one. One style would not be right and the other wrong; the two styles would simply be different.
Evaluation	This is the process of making judgments. Evaluation may or may not involve testing, measurement, or assessment. Most informed judgments of worth, however, would likely require one or more of these data-gathering processes. Evaluation decisions may be based on either quantitative or qualitative data; the type of data being strictly dependent on the nature of the evaluation question (i.e., Has this student demonstrated the skills necessary to become a Program Manager?).

---

## Types Of Test and Assessment Items

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### Introduction

There are several types of test and assessment items available to course designers. Curricula that reside under the DAU are required to have criterion-referenced tests and assessments. That is, each test or assessment item must be *directly referenced* to a specific performance objective. This method is called criterion referencing.

---

### Criterion-referencing vs. norm referenced tests

There are two major ways to interpret test scores: criterion-referenced interpretation and normative scoring interpretation. While some tests can be interpreted both ways, this is usually not the case. Tests should be constructed to facilitate either a criterion-referenced or norm-referenced interpretation.

Basically, norm-referenced tests need to be composed of items that will separate the scores of test-takers from one another, while criterion-referenced tests need to be composed of items based on *specific objectives or competency statements*.

A standard or criterion is written in behavioral terms within the context of the terminal and enabling learning objectives. In competency-based training the *Duty* is usually converted to a TLO and task statements usually represent ELOs.

Thus, learner performance is measured regarding each individual ability to demonstrate *mastery* of the learning objectives. That is, learner achievement is measured against the predetermined criterion established in the performance objectives. Learner's achieve *mastery* or *non-mastery*, *pass* or *fail* grades, and not letter or number grades. Criterion-referenced measures usually result in a much higher level of performance because the standard for performance can be 100% (e.g., competency-based training and education test and assessment).

Conversely, using norm-referenced testing, a learner's performance is compared with the performance of other learners. Achievement is measured on a percentage basis (e.g., 70% of all items attempted is passing) rather than *mastery* or *non-mastery*.

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## Types of Tests and Assessments, Continued

<b>Types of test and assessment items</b>	<p>Without a basic understanding of the principles of test design, several problems can result in the instructional design process. In fact, test development should be on an equal footing with the development of instructional materials. The following are the major types of tests and assessments used to measure student performance:</p> <ul style="list-style-type: none"> <li>• Multiple-choice</li> <li>• True-False</li> <li>• Matching</li> <li>• Completion/Fill-in</li> <li>• Essay</li> <li>• Restricted-response essay</li> <li>• Case Study</li> <li>• Critical Incident</li> <li>• Incident</li> <li>• Practical Exercise</li> <li>• Simulation</li> <li>• Role Play</li> </ul>	<p>Note: The DAU offers a continuing education course for faculty, PDED 3: Developing <i>Criterion-Referenced Tests and Assessments</i> at no charge to its consortium schools. For information or requests, contact DAU.</p>
<b>Required preconditions</b>	<p>Before considering specific suggestions for writing test and assessment items, there are a number of abilities that are necessary to write successful test items.</p> <ul style="list-style-type: none"> <li>• <i>You must have a thorough mastery of the subject matter being tested.</i> You must not only understand the implications of the facts and principles of a particular field, but you must also be aware of the common fallacies and misconceptions.</li> <li>• <i>You must develop and use a set of educational objectives.</i> Unless you consider students are to learn, you will not be able to evaluate their progress or achievement.</li> <li>• <i>You must know the students who will be taking the test in order in order to appropriately adjust the complexity and difficulty of the items.</i> That is, you must know your target audience: Are they entry-level, or are they experienced both educationally and from job experience?</li> </ul>	

## Guidelines for Selecting Assessment Techniques

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### Selecting assessment techniques

The following are guidelines that will assist you in selecting the type of test or assessment technique for the course.

<b>If you want to test for . . .</b>	<b>Then use this type of item . . .</b>
selecting a correct answer from a group of alternatives	multiple-choice.
a “Yes” or “No”, or other types of two-possibility discriminations for each of several cases	true-false.
associating a term or concept with its definition or corresponding property	matching.
making short identifications	completion/fill-in.
explaining or interpreting a relationship more complex than selection, recognition, association, and simple recall	extended response essay.
answering brief questions from memory	restricted response/short answer.
evaluating data and using it to solve a problem	case study.
perform a specific similar to those performed on the job	practical exercise.
demonstrating ability to do a variety of complex job tasks with minimal supervision	simulation.
responding appropriately to situations with many variables that require problem solving processes	incident or critical incident process.
providing practice on previously learned material	role-play.

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## Multiple-Choice Items

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**Introduction** Multiple-choice questions are one of the most popular types of performance test items. They are also one of the most difficult to write.

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**Description** A multiple-choice question is one which has a phrase followed by several possible completions of the phrase, only one of which is correct. Multiple-choice questions can sometimes take the form of an incomplete sentence followed by a series of alternative completions from which the test-taker is to choose one.

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**When to use** Multiple-choice test items are When to use the *objective* calls for the student to select a correct answer from among several alternatives.

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**Components of multiple-choice items** Multiple-choice items have three components:

- The **stem**, or introductory phrase that will be completed by the correct answer.
- The **distractors**, which are the *incorrect* choices. Distractors should be plausible answers representing common errors and misconceptions.
- The answer **key**, which is the correct answer.

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## Multiple-Choice Items, Continued

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**Example #1:**  
**multiple-choice**  
**item**

The following is an example of an objective using a criterion-referenced multiple-choice test item:

<i>Performance Objective</i>	Recognize the purpose of the Component Cost Analysis (CCA).
<i>Item Stem</i>	The purpose of the Component Cost Analysis (CCA) is to:
<i>Distractor</i>	A. present the Program Manager's life-cycle cost estimate.
<i>Key</i>	B. provide an independent check on the program office estimate.
<i>Distractor</i>	C. present the Service's cost position to OSD.
<i>Distractor</i>	D. estimate the cost of a major component of a system.

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## Multiple-Choice Items, Continued

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**Example #2:  
multiple-choice  
Item**

The following is an example of an objective using a criterion-referenced multiple-choice test item:

<i>Performance Objective</i>	Given the latest research about atomic discoveries, select the criteria that would most likely contribute to the advancement of such discoveries in medicine.
<i>Item Stem</i>	What would do the most to advance the application of atomic discoveries to medicine?
<i>Key</i>	A. Development of standardized techniques for treatment of patients.
<i>Distractor</i>	B. Training of the average doctor in application of radioactive treatments.
<i>Distractor</i>	C. Removal of restriction on the use of radioactive substances.
<i>Distractor</i>	D. Addition of trained radioactive therapy specialists to hospital staffs.

**Multiple-choice  
and Bloom's  
Levels**

Multiple-choice questions can assess all of Bloom's cognitive levels except the synthesis and evaluation levels. These two levels require original responses on the part of the student.

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## Multiple-Choice Items, Continued

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### Interpretive multiple-choice questions

Many multiple-choice tests pose a series of separate, unrelated questions. In contrast to this method is the *interpretive exercise* format. These types of multiple-choice questions present a series of test *items based on a common stimulus*. The stimulus can be written material like case scenarios, tables, graphs, maps, pictures, and even audio or videotapes.

Interpretive multiple-choice exercise items can be written to assess a wide range of student abilities, for example: to recognize generalizations, assumptions, or inferences; to apply principles; or to interpret data or experimental findings.

To achieve this, however, the material must be novel or new to the students, not something previously covered in class or found in the text/student guides.

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### Advantage of interpretive method

In addition to the general advantages of multiple-choice items in testing higher level and complex materials, interpretive exercises minimize the influence of irrelevant information because they confine the data to be interpreted to the actual material presented.

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### Disadvantages of interpretive method

Interpretive exercises are more difficult to construct. For written material (which is the most common form), a greater demand is also placed on the test-taker's reading skills.

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## Alternative Choice Items

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<b>Introduction</b>	Alternative choice items assess the student's ability to recognize information instead of selecting the right answers from among a number of possibilities (as in multiple-choice).
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<b>Description</b>	Alternative choice test items provide either a statement or a question that has only two possible choices (alternatives). More commonly known as <i>True-False</i> , alternative choices can also include <i>right-wrong</i> , <i>fact-opinion</i> , <i>example-non-example</i> , etc.
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<b>When to use</b>	Alternative choice test items are appropriate when the objective calls for a clear instance-by-instance acceptance or rejection.
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<b>Example #1: alternative choice item</b>	The following is an example of an objective using a criterion-referenced alternative choice test item.
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<i>Performance Objective</i>	The student will identify the activities required in the various phases of the acquisition life-cycle.
<i>Test Item</i>	One objective of Phase III, Production and Deployment, is to achieve an operational capability that satisfies the mission need.
<i>Alternative 1</i>	A. True
<i>Alternative 2</i>	B. False

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*Continued on next page*

**Alternative Choice Items, Continued**

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**Example #2:  
alternative choice  
item**

The following is an example of an objective using a criterion-referenced alternative choice test item.

<i>Performance Objective</i>	The student should be able to recognize the sum of a triangle.
<i>Test Item</i>	The sum of a triangle is 180.
<i>Alternative 1</i>	A. True
<i>Alternative 2</i>	B. False

---

**Alternative  
choice and  
Bloom's Levels**

Alternative choice items can assess the knowledge, comprehension, and application levels. They are most frequently used to assess the knowledge level.

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**Proceed with  
caution**

Alternative choice questions on written tests are not often used. The rationale is that test-takers have a fifty-fifty chance of getting the item correct either because they knew it or they guessed. Thus, they are not very reliable items to assess learning. The key to writing this type of item effectively is to make sure that the content being tested is truly dichotomous and that more than memorization is required.

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## Matching Items

<b>Introduction</b>	Matching test items present test-takers with two lists or columns of related words, phrases, or symbols.
<b>Description</b>	Matching items require the student to match each item on one list with the appropriate item on the another list. Matching items most frequently take the form of a list of words to be matched with a list of definitions.
<b>When to use</b>	Matching test items are appropriate when the objective calls for the student to demonstrate an understanding of homogeneous content, for example, types of contracts, types of terminations, types of wires, etc.
<b>Items appropriate for matching</b>	<p>The following items are appropriate for matching items on a test:</p> <ul style="list-style-type: none"><li>• Terms with their definitions</li><li>• Short questions with their answers</li><li>• Symbols with their proper names</li><li>• Causes with effects</li><li>• Rules with situations in which the rules apply</li><li>• Parts of mechanical units with their proper names</li><li>• Parts with the mechanical units to which they apply</li><li>• Characteristics with the mechanical units to which they apply</li></ul>

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## Matching Items, Continued

### Example of a Matching Item

The following is an example of an objective using a criterion-referenced matching test item.

<i>Performance Objective</i>	The student will identify the relationship between Program Characteristics and Program Categories.	
<i>Matching Test Item</i>	Match the program characteristic item in Column A with the program categories in Column B. The responses in column B may be used once, more than once or not at all.	
	<b>Column A</b>	<b>Column B</b>
	A. Major Programs	1. Category I
	B. Major Defense Acquisition Programs	2. Category II
	C. Program delegated to Component Head	3. Category III and IV
	D. Milestone Decision Authority at lowest level deemed appropriate	

### Matching and Bloom's Levels

Matching items can assess the knowledge and comprehension levels. However, like alternative choice items, they are not often written beyond the knowledge level.

## Completion/Fill-In Items

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<b>Introduction</b>	Completion/fill-in test items are called “supply-type” items because the answer does not appear before the student.
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<b>Description</b>	Completion/fill-in questions are usually comprised of an incomplete statement followed by a blank line upon which the student writes (supplies) the answer.
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<b>When to use</b>	Completion/fill-in questions are appropriate when the instructional objective requires that the learner <i>recall</i> or <i>create</i> the correct answer rather than simply recognize it.
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<b>Example #1: fill-in</b>	The following is an example of an objective using a criterion-referenced completion/fill-in test item.
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<i>Performance Objective</i>	Describe the calculation of a uniform annual cost (UAC).
<i>Fill-In Test Item</i>	A uniform annual cost is determined by dividing _____ by _____.

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<b>Example #2: completion</b>	The following is an example of an objective using a criterion-referenced completion/fill-in test item.
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<i>Performance Objective</i>	The student should be able to name the central core of an atom.
<i>Completion Test Item</i>	Every atom has a central core called _____.

---

<b>Completion/ fill-in and Bloom’s Levels</b>	Completion/fill-in items can assess the knowledge, comprehension, and application levels. They are written most often, however, at the knowledge level.
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## Extended Response Essay Items

<b>Introduction</b>	Extended response essay is open-ended questions that leave learners free to determine the content and to organize the format of their answer.	
<b>Description</b>	In extended response type questions the student decides which facts are pertinent, and how to organize, synthesize, and evaluate them.	
<b>When to use</b>	Extended response essay questions are appropriate when the objective is to test writing (composition) skills, including conceptualization, organization, analysis, synthesis, and evaluation. It gives the learner maximum choice regarding topic.	
<b>Example #1: extended response essay</b>	<p><i>Performance Objective</i></p> <p>The learner will describe at least two styles of management and compare and contrast their effectiveness in the areas of interpersonal relations, goal-setting, and assessment of results.</p> <p><i>Essay Item</i></p> <p>Write an essay in which you describe two different styles of management. Compare and contrast the effectiveness of the two styles using interpersonal relations, goal setting, and assessment of results.</p>	<p><b>Note:</b> Scoring of extended response essay questions is tricky because they are especially open to violations of rater or inter-rater <b>reliability</b>. Problems can arise due to <b>who</b> scores the question, or <b>when</b> it was scored, in addition to <b>what</b> the learner wrote. How to score extended response test questions is covered in DAU/PDED 3.</p>

*Continued on next page*

## Extended Response Essay Items, Continued

### Example #2: extended response essay

#### *Performance Objective*

The learner will, in an essay describe the federal acquisition process.

#### *Essay Item*

Write an essay which describes the sequential activities associated with the federal acquisition process.

**Note:** any time a student is permitted to develop or supply an original response can make for varied depth levels or detail of the answer. This can cause problems with item **validity**.

How to protect against violating validity or rater/inter-rater reliability is discussed in the DAU, PDED 3 course.

### Extended response and Bloom's Levels

Extended response essay questions can be used to assess all levels of Bloom's cognitive taxonomy. It is the *only* type of test item with this of capability, and the only item type that can truly assess the evaluation level.

## Restricted Response/Short Answer Items

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**Introduction**      Restricted response/short answer questions limit both the content and the form (e.g., describe vs. compare and contrast) of an answer. Restricted response questions are also called “short answer” items.

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**When to use**      Restricted response/short answer items are When to use the objective to be assessed requires that the test-taker recall information unassisted or create an original response. They are the appropriate item forms when we want to test content.

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**Example short answer item**      The following is an example of an objective with a criterion-referenced short answer test item:

<i>Performance Objective</i>	The student should be able to describe two situations that illustrate the application of the law of supply and demand.
<i>Short Answer Test Item</i>	Describe two situations that illustrate the application of the law of supply and demand. Do not use examples discussed in class. Your answer is to be no longer than ½ page for each situation.

---

**Example short restricted response item**      The following is an example of an objective with a criterion-referenced restricted response test item:

<i>Performance Objective</i>	The student should be able to explain the meaning of the standard error of the estimate.
<i>Restricted Response Test Item</i>	Explain what the standard error of the estimate tells one about the quality of a regression equation.

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**Restricted response/short answer and Bloom’s Levels**      Restricted response or short answer test items can assess all of Bloom’s levels except evaluation. Responses to evaluation questions would be somewhat longer.

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## Case Study Items

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**Introduction** The case study can be used either as a teaching or an assessment method. The case method allows learners to review data, identify critical issues, and develop appropriate solutions. A case study can be either complex (with many interrelated issues) or simple, depending on its objectives.

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**When to use** The case method can be used to determine where students are (as a needs assessment), or to determine how well students can apply what they know to a particular set of circumstances.

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**Assessing groups or teams** Case methods are frequently used in such instances as groups or teams.

Assessment solely on an *individual* learner's performance is usually not recommended.

Individual performance in groups *can* be measured by using a Peer Assessment Form

Note: Help in designing Peer Assessment Instruments is available from Instructional Design Specialists' by contacting the DAU.

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**Example case method item** The following is an example of an objective referenced to a specific assessment item.

<i>Performance Objective</i>	Given a case scenario, the student will be able to explain a well integrated acquisition strategy.
<i>Case Method Assessment Item</i>	Using the following case scenario, identify and explain one strength (if any), and one limitation (if any) of the processes used to develop the acquisition strategy for System X.

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**Case method and Bloom's Levels** Because a case study can be either complex or simple, depending upon the objective, it has potential for the full range of Bloom's cognitive levels.

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## Critical Incident Method

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**Introduction** A critical incident is when the learner is given a brief, hypothetical situation and asked to provide a solution or reaction on the principles learned in the classroom. Critical incidents usually engage learners in a situation that deviates from that which is normal (e.g., given a situation under which “war time” conditions exist; would processes, procedures, or behavior be any different?).

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**When to use** The critical incident method is particularly good to assess performance objectives that require the learner to choose from among several responses.

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**Example critical incident** The following is an example of an objective referenced to a critical incident assessment item.

<i>Performance Objective</i>	Given a scenario and guidelines on the process of conducting a preaward fact-finding site visit, propose solutions to problem(s) encountered during such visits.
<i>Critical Incident Assessment Item</i>	You are at a preaward fact-finding visit to a contractor’s plant for a Firm Fixed Price (FFP) contract. In an effort to develop the cost estimate and determine the capabilities of the contractor’s resources, you have requested specific data that the contractor has refused to provide. What other options do you have to obtain that data?

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## Incident Method

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<b>Introduction</b>	The incident process is a variation of the case study method. Learners are given minimal or conflicting facts and then asked to analyze what additional data is needed to resolve the problem.
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<b>When to use</b>	The incident method is particularly good to assess objectives that require fact-finding; it particularly suits jobs requiring fact-finding ability.
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<b>Example incident method</b>	The following is an example of a performance objective referenced to an incident assessment item.
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<i>Performance Objective</i>	Given a job reclassification problem, compare the position description for the jobs involved and determine the questions necessary to establish whether the [reclassification] is possible.
<i>Incident Method Assessment Item</i>	A supervisor calls you and requests that you rewrite a GS-235 Employee Development Specialist vacancy announcement into a GS-1701, Education Development Specialist position. What questions must you ask to find out if this is possible? Position descriptions are attached.

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## Practical Exercise Method

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**Introduction** A practical exercise is an activity in which the learner actually performs what he or she is going to be doing on the job. As with the case study method, using the practical exercises requires careful planning and must have *predetermined*, stated criteria. Also as the case method, practical exercises may be used to determine where learners are (needs assessment), or if they can apply what they know to a particular set of circumstances.

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**When to use** The practical exercise is appropriate when the objective(s) call for the learner to perform in a job-related situation.

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**Example:  
practical exercise** The following is an example of an objective referenced to practical exercise assessment item.

<i>Performance Objective</i>	<p>Provided several sample completed Forms 11 and 11b, the student will be able to “blue pencil” them at a rate of 10 per hour. The student will:</p> <ul style="list-style-type: none"> <li>a. Examine and perform checks.</li> <li>b. Compare remittance with amount due on documents.</li> <li>c. Blue pencil amounts on the documents</li> <li>d. Prepare Forms 2007 and 3737</li> <li>e. Separate Forms 11 and 11b</li> </ul>
<i>Practical Exercise Assessment Item</i>	<p>Blue pencil the Forms 11 and 11b contained in this envelope. You have 1 hour to complete all 10 forms.</p>

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## Simulation Method

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### Introduction

A simulation is an assessment method in which learners are asked to act out a long-term process or take part in an event pretending real life. Simulations can serve as instructional or assessment methods that attempt to duplicate real-life job conditions as closely as possible or through a series of related exercises.

A case study or practical exercise usually involve a single problem-solving event, a simulation includes many factors which would otherwise be difficult to replicate in a classroom setting.

*Example:* A simulated negotiation exercise, as in CON 104.

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### When to use

Simulations are appropriate when the objective(s) require the learner to engage in specific duties or tasks associated with competency-based designs. Simulations can be used as assessments if they are scored in such a way that success in the simulation is *dependent* on the skill being performed. Simulations represent a powerful assessment mechanism for competency-based training programs or interventions.

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### What you should know

A simulation exercise can focus on the application of a single competency, or, on the use of several competencies in conjunction with each other. Critical path assessments of the subordinate tasks to the principal competencies can also be completed.

Simulations used for assessment purposes can be as simple or complex as the designer wants them to be. What must always be clear to the learner are the performance expectations, activities, and the conditions for successful performance.

In general, when designing an instructional or assessment simulation, it should replicate as close as possible the manner in which the competency is used on the job.

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## Simulation Method, Continued

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**Example:  
simulation**

The following is an example of an objective referenced to a simulation exercise assessment item.

<i>Performance Objective</i>	Given situation data, and in the role of a Program Manager, identify and resolve the problem(s) presented
<i>Simulation Assessment Item</i>	You are a Program Manager. The Source Selection Advisory Council asks you to serve as consultant and to critique the attached contractor proposal 2 hours before the meeting of the Council. You are to provide a briefing of your concerns relative to this request. Your briefing must provide (1) problems that may occur if the contractor's proposal is accepted and (2) the influence of the program/proposal on cost, personnel, and time to completion.

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## Role Play

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**Introduction** A role play is an attempt to reproduce, before actual job contact, the dynamics of personal interactions. It can be used as either an assessment device or learning method.

Role play is an interaction among two or more individuals on a given topic or situation

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**When to use** Role plays are used extensively in, but are not limited to the following:

- human relations training
  - counseling
  - instructor training
  - interpersonal skills
  - interview techniques
  - supervisory/management training
- 

**Example role play** Here is a sample role play where the objective is for the learner to demonstrate skill in interpersonal communication.

<i>Objective</i>	Given a situation with a “troubled employee,” the learner will discover the major problem underlying the employee’s comments by demonstrating empathetic listening skills.
<i>Role Play Assessment Item</i>	In a referral interview with a troubled employee, discover the main problems underlying the employee’s comments, using empathetic listening skills.

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**What you should know** If the role play is used as an assessment device, a rating sheet or checklist must be devised to ensure uniformity of assessment (reliability). The roles so that no matter who does the acting, the points necessary for rating students skills are revealed.

Role plays are difficult as assessment devices because they generally provide low test and test scorer reliability. They are also highly subject to bias on the part of the observer/grader.

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## Item Analysis: Validity

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### Introduction

Analyzing performance-based, criterion-referenced test items is not a difficult process. Effective item analysis can actually be viewed as multidimensional and involves two basic questions:

- Is the item valid; does the item match the objective?
- Is the item reliable?

Effective test and assessment items should be able to stand up against *both* of these questions.

---

### Item Validity

To match the objective, the test or assessment item must

- test the proper performance
- be at the proper level (conditions and standards)
- be free from unrelated skills
- be free of “tricks”

A valid test is one which measures knowledge and skills needed for job success. A valid performance test is based on task or need analysis and the learning objectives.

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### Matching the objective to proper performance

To test the proper performance, check to see that there is a sound match between the action verb and the performance required by the test item.

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**Item Analysis: Validity, Continued**

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**Example/non-example of item validity**

After reading the objective below, decide which of the two test items best measures the performance in the objective.

*Objective:* Identify the unit used to measure the amount of radiation absorbed by a substance.

*Test item #1:* The amount of radiation absorbed by a substance is measured in

- A. rods.
- B. r units.
- C. rads.
- D. rems.

*Test item #2:* The amount of radiation absorbed by a substance is measured in \_\_\_\_\_.

Test item #1 best measured the performance stated in the objective. Item #1 asked the learner to *identify* the unit, as stated in the objective. Item #2 asks for complete recall and is not valid because it calls for *supplying* rather than *identifying* information.

---

**Matching the objective to the proper level**

In addition to testing for proper performance, it is important to attend to the proper *skill* and *knowledge* level of the objective. This level might be indicated by *either* the conditions or the standard stated in the objective.

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## Item Analysis: Validity, Continued

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**Example:  
matching the  
level of the  
condition**

The *conditions* of an objective often call for the use of specific instructional aids such as diagrams, reference manuals, or tables.

For example, post office clerks are given access to charts and tables when they are selling postal services or carrying out other duties. With that in mind, look at the objective below and its test item and see if you can determine if it *matches the level of testing*.

*Objective:* Using the *Domestic Mail Manual* as a guide, identify the necessary forms needed to process any given piece of undelivered-as-addressed mail.

*Test Item:* A letter returned to the post office due to the addressee moving without leaving a forwarding address should be processed on Form(s) \_\_\_\_\_ and \_\_\_\_\_.

The test item obviously *is not* a valid measure of the objective. Why? Without the manual (stated as a condition) the student is expected to know all the information about processing “undeliverable-as-addressed” mail and (as stated in the condition) any “necessary forms.” The objective does not demand this level of knowledge.

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**Item Analysis: Validity, Continued**

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**Example:  
matching the  
level of the  
standard**

A test item can also test at an improper level by not matching the standards of the objective.

For example, an objective for a word-processing student demands certain standards of speed and accuracy, as in the following objective. See if you can determine whether the test item is valid.

*Objective:*      Given 8 medical terms, correctly type the words within 1 minute.

*Test Item:*      Type these medical terms:

Meningitis	Pneumococcal
Pyogenic	Pyelonephritis
Lymphoedema	Distichiasis
Dyspepsia	Inoculation

The test item *is not* valid because it fails to include the standard of the objective “within 1 minute.”

---

**Matching the  
objective to the  
proper skill level**

In order for a test item to be completely valid, it must test only those skills directly contained in the objective. To do so, the item must be

- free of unrelated skills, and
  - free of tricks.
- 

**Matching the  
objective to the  
proper skill level**

It is important that the test items do not test unrelated skills. For example, test items that are written at a higher verbal level than the learner possesses are actually testing comprehension. Test items must be easily read and understood by the learner.

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## Item Analysis: Validity, Continued

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### Avoid testing unrelated skills

Skills might be unintentionally tested such as drawing diagrams, interpreting specifications, or blueprints and maps, as in the following example using a test item for a lab assistant.

*Objective:* Locate any given piece of equipment in the laboratory.

*Test Item:* Match the location indicated on the map of the laboratory to the equipment stored in each location by writing the corresponding letter in the blank provided.

\_\_\_\_\_ Bunsen burners  
\_\_\_\_\_ Microscope  
\_\_\_\_\_ Safety apparel  
\_\_\_\_\_ Eyewash  
\_\_\_\_\_ Glassware

This, of course, is not a valid measure of the objective because the test item is testing a skill (map reading) unrelated to the objective.

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### Make sure the item is free of tricks

It is important that learners understand what knowledge or skills are being tested. So-called trick questions seem to be testing one skill while they are actually testing another.

A trick question is invalid because it does not really test the learner's *mastery* of the objective; it merely tests the learner's ability see through the trick. Although a bit dramatic, the Allen wrench test item below is a trick question. It uses a misspelled word to trick the test-taker.

*Objective:* Distinguish whether or not a given tool is appropriate for a given task.

*Test Item:* An Alan wrench can be used to loosen a bolt or screw.

- A. True
- B. False

Since the test item misspells a critical word, it is considered to contain a "trick."

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**Item Analysis: Reliability**

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**Item reliability** Reliability is another quality or characteristic of well-written test items. A reliable item is one that gives consistent results. Test items that are confusing or give hints to test-wise test-takers are not reliable.

The two main characteristics of reliable test items are:

- The test item must be free from ambiguity.
  - The test item must be free from clues.
- 

**Freedom from ambiguity** To be free from ambiguity test items must:

- Be written in clear language.
  - Have one clear theme.
  - Make careful use of negatives.
- 

**Clear language** If a test item is unnecessarily wordy or has a confusing grammatical structure, the item may not test the learner on the intended knowledge or skill and may yield inconsistent results, as in the following item.

*Poor Test Item:* The energy possessed by any object or being, in space and time, owing to its motion or movement regardless of the cause of said motion, is called \_\_\_\_\_ energy.

The item is obviously confusing. It tests the learner's ability to unravel the statement as much as it tests the required knowledge. It could be improved by simplifying the wording, like this:

*Improved Item:* The type of energy illustrated by the motion of an object is \_\_\_\_\_ energy.

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## Item Analysis: Reliability, Continued

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**One clear theme** When an item tests more than one theme or idea it is difficult to know how to respond, as in this true-false item:

*Test Item:* Rotational motion is the movement of an object in a circular path, while angular displacement is the measurement of the amount of rotation of a body about an axis.

- A. True
- B. False

If learners answer incorrectly, we cannot be sure whether or not they failed one or both parts of the question, or whether the two parts of the item confused them so that they were unable to interpret the question.

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**Careful use of negatives** Avoid using negatives in test items, if at all possible. Negatives add confusion when learners are reading quickly, which frequently occurs during tests.

It is easy to miss small word segments such as *not*, *un-*, or *mis-*. We should try to write items in a positive form. If this is not possible, emphasize negative words by underlining, CAPITALIZING LETTERS, *italics*, or **bold type**, as in this example:

Test Item: An “open” is caused when there is **not** enough voltage going to the circuit divide.

- A. True
- B. False

Although it is best to avoid negatives, the test item is not difficult to interpret because the negative is emphasized [in this instance] by **bolding** it.

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## Item Analysis: Reliability, Continued

### Avoid using double negatives

Avoid using double negatives; there is no rationale for doing so. When two negatives are used in an item, it becomes difficult to interpret. An item not easily understood by learners is unreliable.

Keep in mind that double negatives are not always easy to spot. Words with prefixes like *in-*, *un-*, *mis-*, or *dis-* are negatives too. The following example is of an item using a double negative.

*Test Item:* An SCR will not stop conducting when the holding current does not rise above the cutoff valve.

- A. True
- B. False

The item is difficult to interpret because the word “not” is used twice.

### Freedom from clues

The second major characteristic of reliable test items is freedom from clues. To be free of clues, the test item must:

- Use plausible distractors
- Have a random order of answers.

### Using plausible distractors

Multiple-choice and matching items consist of some responses that are not correct, called *distractors*. If the distractors are implausible, the learner may be able to guess the correct answer by eliminating responses that cannot fit. For example, we can look at the following sample test item to see if it is reliable.

*Test Item:* Complete the sentence under column A by matching the formulas in column B.

#### Column A

The area of a rectangle is \_\_\_\_\_.  
The area of a 2-inch square is \_\_\_\_\_.  
The area of a triangle is \_\_\_\_\_.

#### Column B

- a. 4 square inches
- b.  $L \times W$
- c. 6 square inches
- d.  $\frac{1}{2}$  distances  $\times H$
- e.  $2 \times L$

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## Item Analysis: Reliability, Continued

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**Random order of answers** It is important to randomize the order in which the alternative responses fall. Use a logical order for alternative responses, such as alphabetical, or in order of magnitude.

The point is to avoid a pattern for correct responses throughout the test. Test-wise students will be able to spot the pattern and use it as a cue to the correct response.

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**Summary** Reliability and validity are the two most important characteristics of a test. Validity determines whether a test measures what it should. A test can, in fact, be consistent (reliable) but measure the wrong thing. Reliability actually involves the consistency of test scores and involves test-retest and inter-rater functions. What is important to remember is that there is no such thing as validity without reliability.

Note: Specific types of validity and reliability are covered in PDED 3, *Developing Criterion-Referenced Test and Assessments*.

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## Deciding How Many Test Items

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### Introduction

One frequently asked question associated with criterion-referenced testing is: How many questions should be on a test? The question does not have a simple numerical answer. However the improvement in accuracy tends to level off between four and six items per objective. The question is important, however, because the length of a test has a direct relationship to [the] test's validity and reliability.

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### Factors in deciding test length

The question of test length hinges on at least four factors:

- The criticality of the *mastery* decisions made on the basis of the test.
- The resources—time and money—available for testing.
- The domain size described by the objectives to be addressed.
- The homogeneity or relatedness of the objectives to be assessed.

Each of these four factors will be briefly discussed. Each of the four factors can be regarded in terms of influence on the decision of test length.

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*Continued on next page*

## Deciding How Many Test Items, Continued

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### Criticality and Test Length

A simple method for resolving the issue of criticality is to ask the question: *What are the costs to the organization of employees of erroneously clarifying a non-master as a master?*

Thus, the extent to which errors in clarification can be tolerated, tests can be shorter. But, if the consequences of clarification errors are severe, the tests used to make mastery/non-mastery decisions will have to be longer and still meet the requirements for test validity and reliability.

---

### Resources and test length

The creation of tests takes time and costs money. The longer and more sophisticated the test, the greater the developmental costs. There are also costs associated with maintaining and scoring tests.

Tight budgets necessitate the need to trade off the cost of test development and implementation against the cost of errors in test results. Knowing the consequences of testing errors is essential toward balancing this trade-off wisely.

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### Domain Size of Objectives and Test Length

The number of items required for a test is influenced by the objectives that the test is designed to assess. In general, the larger size of the domain of content described by an objective, the fewer the items required to assess the objective adequately.

Most objectives require more than one test item—called parallel items—to assess them adequately.

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*Continued on next page*

## Deciding How Many Test Items, Continued

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### Homogeneity of objectives and test length

Homogeneity of objectives has to do with their relationship to each other. Consider these two objectives:

- A. Without access to references, describe the steps in conducting a performance appraisal.

*and*

- B. Without access to references, describe the four stages of interpersonal communication.

These two objectives are related because the content they cover is similar. In fact, the objective **B** is very likely a prerequisite to objective **A**. As a result, test-takers are likely to perform the same way on the test items written for these two objectives.

If objectives are homogeneous to the extent that they result in test items to which test-takers respond similarly, fewer items need to be included to assess each objective independently. Conversely, if the objectives covered by the test are largely unrelated—heterogeneous—we would expect that the test would have to be considerably larger since several items will probably be required for each objective.

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*Continued on next page*

## Summary

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**Section summary** In this section of the *Guide* we have focused on assessing student performance. Testing and assessment is one of the most important aspects of the teaching-learning process. We have discussed the significance of referencing test and assessment items to the criterion stated in the performance objectives, introduced several types of tests and assessment items available to course developers, addressed the importance of test item validity and reliability, and considered the factors in deciding how many items it takes to make a test reliable.

Several standard textbooks in the Reference and Suggested Readings on the next page give detailed suggestions for designing and developing the types of test and assessment items covered in the Section. We also provide additional guidance and checklists in the appendices of this *Guide*.

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## Section References and Suggested Readings

### References

- Campbell, C.P., and Hatcher, T.G. (May/June 1989) "Testing That Is Performance-Based and Criterion-Referenced. " *Performance and Instruction*.
- Cascio, W.F., Alexander, R.A., and Barrett, G.V. (1988) "Setting Cutoff Scores: Legal, psychometric, and Professional Issues and Guidelines." *Personnel Psychology* (41), pp. 1-24.
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- Hawkins, R. L. (October, 1993). *Criterion-Referenced Testing: The Integration of Curriculum and Testing*. Norfolk, VA: Naval Center for Acquisition Training.
- Shrock, S.A., and Coscarelli, W.C. (1989) *Criterion-Referenced Test Development: Technical and Legal Guidelines for Corporate Training*. New York: Addison-Wesley Publishing Company.

### Suggestions for Further Reading

- Coffman, W.E. (1971). *Essay Examinations*, In R.L. Thorndike (Ed.) *Educational Measurement* (2d ed., pp. 271-302) Washington, DC: American Council on Education.
- Ebel, R. L. (1981). *Measuring Educational Achievement*. Englewood Cliffs, NJ: Prentice-Hall.
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- Hopkins, K. D., and Stanley, J. C. (1981). *Educational and Psychological Measurement and Evaluation* (6th ed.). Englewood Cliffs, NJ: Prentice-Hall.



## Section VII

### Technology-Based Education and Training

#### Overview

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##### Introduction

The DAU is committed to providing high-quality education and training to the members of the DoD acquisition component. Emerging technologies provide DAU with the ability to increase access to its courses while promoting effective learning experiences for individuals.

DAU's vision for technology-based education and training is:

Provide an educational program that fully supports a culture of continuous learning and allows convenient, cost-effective access to education, training, performance support, and expert advice to all members of the acquisition community.

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##### Where you can find it

The DAU Technology-Based Education and Training Plan may be viewed at: <http://www.acq.osd.mil/dau>.

The World Wide Web as a Distance Learning (DL) Method/Mode/Media Tool may be viewed at:  
<http://www.txdirect.net/users/jeturner/dauweb00.htm>.

---

##### How this section can be used

This web-site is designed to provide resources and tools to the DAU faculty that both enlightens and provides a communication vehicle among DAU Staff and faculty.

- It introduces and provides instruction on navigating through the world wide web (WWW)
  - It shares some of the new technologies
  - It shows what can and is being done in the WWW environment, and
  - It provides references, links, and resources to gain further knowledge on technology-based education and training.
-





## Appendix A

### DAU Academic Program Review Curriculum/Course Revision Process

#### Overview

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##### Introduction

The DAU has developed a process for comprehensive reviews of DAU courses and academic programs. It consists of an academic review team composed of representatives from DAU, the schools, and functional working groups.

There are three components of the DAU Academic Program Review.

- **Curriculum laydown**—reviews performance outcomes, current course materials, and determines the scope of modification.
  - **Interim quality review**—ensures program is technically accurate, relevant, and educationally sound. It is conducted every 6 months, except during curriculum laydown.
  - **Quality assurance site visit**—ensures program or course is technically accurate, relevant, and educationally sound through a visit to the school's training site. It is conducted annually.
- 

##### When to use

Use the processes listed in the table for each appropriate review.

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*Continued on next page*

## Overview, Continued

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### Curriculum laydown 0

The curriculum laydown ensures that the DAU program for a particular functional area is technically accurate, relevant and educationally sound. The steps are as follows:

Step	Action
1	Establish working group to review course materials.
2	Review performance outcomes and course materials.
3	Determine the scope of modification and broad student outcomes.
4	Review all elements of course including terminal learning objectives and enabling objectives, course content and materials, and student assessments.
5	Schools submit revision plan and schedule and revise the course.
6	Conduct “train the trainer session” to familiarize instructors with new materials.
7	Confirm that all changes and revisions requested are made and conduct initial offerings of the course.

---

### Interim quality review

The interim quality review is conducted every 6 months except during curriculum laydown. The steps are as follows:

Step	Action
1	Schools present synopsis of student and instructor feedback.
2	Identify necessary changes, based on legislation, policy, practices.
3	Determine if current course(s) content is technically accurate and up-to-date and the course is educationally sound.
4	Develop a plan with a timeline to make changes if needed.
5	Certify that changes are made and in compliance with policy.

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*Continued on next page*

## Overview, Continued

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**Quality assurance site visit** The quality site visit is conducted annually. The steps are listed as follows:

Step	Action
1	Visit the sponsor's resident site through attending class and holding informal discussions with faculty and students.
2	Discuss proposals for changes to course content or instructional methodology.
3	Develop a plan with timeline for implementation if needed.

---

**Checklist points** Use the checklists below as a guide during the reviews.

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**Learning objectives review** All points should be covered.

Identify quality standard for objectives	
	Objectives always have an action verb.
	Acceptance criteria as stated is measurable or observable for each objective.
Match terminal and enabling objectives	
	Enabling objectives advance the learner to the terminal objectives.
	Enabling objectives are learner sequenced, thus ensuring that content also follows a similar sequence

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*Continued on next page*

## Overview, Continued

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**Training  
materials  
evaluation**

<b>Instructor Guide</b>	
	The tasks to be taught are identified by a terminal objective.
	Enabling objectives correspond to knowledge, skills, abilities, and attitudes required to perform the task.
	Objectives can be traced to knowledge, skills, abilities in task analysis data.
	Lesson plans are properly sequenced and supports the objectives.
	Handouts, films, overhead, and other media support the instruction and are legible.
	Instructor guide objectives correspond to the skill and knowledge required that were identified during job and tasks and analysis?
<b>Instructional Methods</b>	
	Choice of methods of instruction supports learning outcomes.
	Level of instructional interactivity (e.g. student and instructor and student to subject matter)
<b>Trainee Text Materials</b>	
	Text covers all objectives
	Text provides a useful reference for the lesson/course
<b>Exercises</b>	
	Objectives match exercise activities.
	Information is adequate for instructor and learner to prepare and perform the practical exercise.
	Objectives can be traced to the analysis.

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*Continued on next page*

## Overview, Continued

### Assessment review

<b>Test or Assessment Characteristics</b>	
	Test or assessment questions are referenced to terminal or enabling objectives as appropriate.
	Measurement of test performance is based on criteria or standards.
<b>Mastery of all test items is required before continuing in the training or education curricula.</b>	
	Validity-compares performance test outcomes to terminal objectives
	Test compares terminal objectives to need or task analysis
	Reliability-technical accuracy, design adequacy, percentage indication dependent on sample size.
<b>Test Analysis</b>	
	Identifies what test items appear to be deficient?
	Identifies what content areas based on test results, was probably ineffectively taught?

### Instructional course evaluation

<b>Course content material</b>	
	Introductions are effective (e.g. clear, motivational, etc.)
	Objectives are behaviorally written
	Objectives match lesson content
<b>Course length</b>	
	Time allocated exercises, discussions, lecture, etc. is appropriate.
<b>Lesson Platform Presentation</b>	
	Content organization is logical and supports objectives.
	Explanations or demonstrations are clear and understandable.
	Examples, analogies, etc. Opportunities of Practice support instruction.
	Student activities matched objectives

*Continued on next page*

## Overview, Continued

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Instructor course  
evaluation,  
continued

Instructional Aids	
	Matched to objectives
	Used appropriately
Planning and Preparation	
	Instructor time budgets effectively
	Instructor is familiar with lesson content

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## Appendix B

### DAU Technology-based Redesign Process Plan (Curriculum Transition Process)

#### Overview

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<b>Overview</b>	DAU course conversion from classroom to technology-based training methods uses a systematic approach that involves the school, functional board, functional representatives, DAU program coordinators, and contractors.
<b>DAU Curriculum transition process</b>	The DAU curriculum transition process is described in detail in the DAU Plan for Technology-Based Education and Training Concept Document. It is available for viewing on the DAU Homepage at: <a href="http://www.acq.osd.mil/dau">http://www.acq.osd.mil/dau</a> .
<b>Redesign plan</b>	The DAU Technology Based Redesign Process Plan (Computer-Based Training) describes the date, steps, responsibilities, actions, and products resulting from the curriculum transition. It is available for viewing on the DAU Home Page at: <a href="http://www.acq.osd.mil/dau">http://www.acq.osd.mil/dau</a> .
<b>In this appendix</b>	In this appendix you will find the following topics:

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Topics	See Page
DAU Curriculum Transition Process	<a href="http://www.acq.osd.mil/dau">http://www.acq.osd.mil/dau</a>
DAU Technology-Based Redesign Process Plan (Computer-Based Training)	<a href="http://www.acq.osd.mil/dau">http://www.acq.osd.mil/dau</a>

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## Appendix C

### Writing Learning Objectives

#### Writing Learning Objectives

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**Introduction** Learning objectives form the foundation of any educational intervention. Before developing instructional materials, decisions must be made about what the learners are expected to do as a result of a lesson, course, and curriculum.

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**In this section** This section covers the following topics:

Topics	See Page
Writing Learning Objectives	C-1
The Purpose and Characteristics of Performance Objectives	C-3
Developing Performance Condition Statements	C-7
Developing Performance Statements	C-8
Developing Performance Criterion Statements	C-9
Bloom's Taxonomy of the Cognitive Domain	C-10
Bloom's Level 1—Knowledge	C-11
Bloom's Level 2—Comprehension	C-12
Bloom's Level 3—Application	C-13
Bloom's Level 4—Analysis	C-14
Bloom's Level 5—Synthesis	C-15
Bloom's Level 6—Evaluation	C-16
Section Summary	C-17
Section References	C-18

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**Definition** A learning objective is a clear statement of the behaviors expected of the learner, as a result of a course or unit of instruction.

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## **Writing Learning Objectives, Continued**

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<b>Description</b>	<p>Performance-based learning objectives can be written in a variety of styles and can be included in the specification of a performance outcome. Objectives have three characteristics:</p> <ul style="list-style-type: none"><li>• They state performance, or what the student should be able to do. Performance should be as close to actual job performance as possible.</li><li>• They specify the conditions under which the student is to perform.</li><li>• They specify the criteria for acceptable performance; the standards from which the degree of achievement can be measured or observed.</li></ul>
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## The Purpose and Characteristics of Performance Objectives

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<b>Introduction</b>	Performance-based learning objectives are purposeful and an inherent part of the instructional planning process. Task or need analysis forms the foundation of the learning objectives; therefore, the learning objectives should tie directly back to analysis.
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<b>Purposes of objectives</b>	<p>Performance-based learning objectives have three purposes. They provide:</p> <ul style="list-style-type: none"><li>• a sound basis for selection and design of instructional materials</li><li>• standards for determining whether instructional outcomes have been achieved, and</li><li>• students with a framework for performance.</li></ul>
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<b>Definition</b>	A learning objective is a clear statement of the behaviors we expect our learners to demonstrate as a result of learning. That is, what we want students to be able to exhibit at the end of a course or unit of instruction.
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*Continued on next page*

## The Purpose and Characteristics of Performance Objectives, Continued

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### Levels of objectives

There are three levels of performance objectives.

Objective Level	Description
Course Objective	This is the highest level of objective, which indicates what the learner will do at the end of the course.
Unit or Module Objective	A statement of what the learner will do after a group or series of lessons.
Lesson Objective	<p>Lesson objectives are the most commonly developed in DAU courses. There are two types of lesson objectives:</p> <ul style="list-style-type: none"> <li>• <i>Terminal Learning Objectives</i> (TLOs), which describe the performance students should exhibit at the end of a significant body of instruction.</li> <li>• <i>Enabling Learning Objectives</i> (ELOs), which are subdivisions of terminal objectives. Enabling objectives describe the separate behaviors that, taken together, build toward <i>mastery</i> of the TLO.</li> </ul>

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*Continued on next page*

## The Purpose and Characteristics of Performance Objectives, Continued

### Sample TLO

Here is an example of a terminal learning objective:

Given simulated technical evaluations, source selection reports, and proposals from unsuccessful offerors, develop a documented rationale for not awarding to an unsuccessful offeror.

### Sample ELOs

Here are some examples of enabling objectives:

- Distinguish which reports are sufficient.
- Identify technical representatives needed to assist in the debriefing.
- Identify technical deficiencies (from technical report) and the basis for not awarding, as well as material not to be disclosed.
- Prepare written documentation for a briefing session.

### Writing clear objectives

There is a six-step process that can be used in writing clearly defined performance objectives:

Step	Action	Note: Bloom's hierarchy in the cognitive domain of learning is recommended for performance-based designs because it is based upon both a <i>learning</i> and a <i>content</i> hierarchy
1	Using each instructional goal, separate each goal into tasks or behaviors that can be managed by the target population (based on the learning characteristics of the students).	
2	Using the content of the module/lesson to be presented, choose a hierarchy of learning on which to structure your objectives. Levels of difficulty is the most common hierarchy; simple to complex. Organize the behaviors into a hierarchy of learning.	
3	For each learning task, identify the desired performance outcome in behavioral terms.	

*Continued on next page*

## The Purpose and Characteristics of Performance Objectives, Continued

Writing clear  
objective,  
continued

This table is continued from the previous page.

Step	Action	Note: If the same method is to be used to evaluate a set of objectives, state a specific question or activity that is to be used for evaluation with that method. For example, a graded, criterion-referenced case study or practical exercise.
4	For each performance outcome, identify the conditions under which the student will perform.	
5	For each performance and condition, identify the expected level of <i>mastery</i> .	
6	For each clearly stated objective, identify the criterion and method for evaluating that specific objective.	

## Developing Performance Condition Statements

---

**Introduction** A terminal learning objective includes a statement identifying the condition(s) of performance. Some instructional designers think of it in terms of the *conditions of testing* (or assessment), because they are trying to communicate the conditions under which the student will be asked to demonstrate *mastery* of the knowledge and/or skills learned.

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**Definition** A performance condition statement is a description of the resources or tools the learner will need to complete the measurable or observable behavior.

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**Guideline** A condition is usually established with the word “Given” followed by such phrases as

- a set of questions
  - a scenario
  - a series of problems
  - a visual representation of an object
  - a list of conditions
  - a choice between...
  - materials (list components), or
  - a calculator.
- 

**Implied Conditions** Frequently objectives are written with no condition(s) of performance stated. When this occurs, the condition is

- stated in the terminal objective and then subsumed by the enabling objectives, or
- is implied within the context of the performance statement.

Example: The student will write the formula used for cost accounting with no errors.

Explanation: In this example, the implied condition is *Given pencil and paper, and no references...*

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## Developing Performance Statements

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<b>Purpose</b>	The performance statement is the second of the three parts of a learning objective. It is the most critical because it describes what the learner will be able to do as a result of the unit or module of instruction.
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<b>Definition</b>	The performance statement is a description of learner activity, using a specific verb which clearly and concisely identifies a measurable or observable behavior.
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<b>Use action verbs</b>	When writing performance statements, use only specific verbs. Specific verbs make the desired behavior clear and, therefore, observable or measurable.
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<b>Examples of specific vs. ambiguous verbs</b>	<p>Below are some examples of specific versus ambiguous verbs.</p> <p><i>Specific verbs:</i> identify, select, complete, locate, write, compute.</p> <p><i>Ambiguous verbs:</i> know, comprehend, understand, appreciate, be familiar with.</p>
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<b>Performance verbs</b>	Performance statements are comprised of verbs that describe what the learner will be doing. A performance statement can begin with: “the learner will...” and be followed by such words as any of the following that describe performance:
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match	select	state	eliminate	label
write	define	fill-in	construct	isolate
type	solve	design	categorize	perform
list	measure	describe	cost out	underline

... trace the steps of	... perform steps in order
... generate solutions for	... explain in essay form
... press the key that	... list the characteristics of
... discriminate by	... analyze the properties of

---

## Developing Performance Criterion Statements

---

**Introduction**      The third component of a well written learning objective is the criterion, or standard for acceptable performance.

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**Definition**      A performance criterion statement is a statement of the quality or quantity standards required for acceptable achievement during the training or education program.

Criterion statements can also be referred to as “level of *mastery*” statements.

A criterion may include specifications relating to time, speed, accuracy, or overall quality.

---

**Level of mastery indicators**      The level of mastery usually follows the performance statement with such phrases as those listed below:

- ...Percent of the time
- ...Number out of number of times
- ...with percent of accuracy number out of number of attempts
- ...with less than number
- ...in (state amount) of time

Levels of mastery may be *implied* by using phrases that illustrate 100% accuracy, such as:

totally	each	corresponding
correctly	all	successfully
accurately	every	without error

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## Bloom's Taxonomy of the Cognitive Domain

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### Introduction

Developing performance-based learning objectives that evolve from need or job task analysis usually result in content hierarchical analysis. For example, using the results from task analysis, task statements are arranged in a *sequence for learning*. Learning sequences can be from beginning to end, by order of performance, or chronological.

A practical and workable approach to validating a hierarchy of knowledge is to identify the learning level of each objective, and then see if the levels are in the proper sequence from a learning theory viewpoint.

The cognitive domain developed by Dr. Benjamin Bloom and his associates is the most widely accepted in the development of competency/performance-based, criterion-referenced instructional designs.

---

### Definition

Bloom's Taxonomy is a classification scheme that breaks down cognitive (thinking) processes into six steps: knowledge; comprehension; application, analysis, synthesis, and evaluation.

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### Description

Bloom's taxonomy is considered a learning hierarchy because each level-of-learning is subsumed by the next higher level. That is, it is assumed that in order to function at the application level, a learner must also be able to function at all levels below application (comprehension and knowledge).

Bloom's learning hierarchy can be thought of as building blocks. You must have factual knowledge before you can understand theory. You must comprehend theory before you can apply it, and so on up the hierarchy.

Thus, when developing a hierarchy of objectives, each objective can be classified according to a Bloom's cognitive level and subsequently cross-checked against a task or content hierarchy.

Tasks, objectives, or test items are classified at the highest level of cognitive functioning they require. Therefore, even though analysis level tasks also involve application, comprehension, and knowledge, they are said to be *at the analysis level*.

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*Continued on next page*

## Level 1—Knowledge

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**The knowledge level**

Knowledge is defined as the remembering of previously learned material. This may involve the recall of a wide range of material, from specific facts to complete theories, but all that is required of the student is the recall of the appropriate information. Knowledge represents the lowest level of learning outcomes in the cognitive domain.

---

**Related Knowledge Level Verbs**

The following is a list of some of the common knowledge level verbs.

Acquire	Group	Locate	Quote	Reproduce
Choose	Match	Read	Select	Count
Recall	State	Define	Identify	Memorize
Name	Recite	Tabulate	Indicate	Recognize
Trace	Draw	Pick	Record	Underline
Label	Point	Repeat	Write	Find

Note: This and other verb lists provided are illustrative, not exhaustive.

---

**Typical tasks at the knowledge level**

The knowledge level of learning calls for objectives that require simple recall of previously learned material. Some typical knowledge tasks are:

- Name
  - List
  - Define
  - Who? What? When?
  - *Yes* or *No* questions
  - How many? How much?
  - Describe
  - Label
  - Match
  - Select
- 

*Continued on next page*

## Level 2—Comprehension

### The comprehension level

Comprehension is defined as the ability to grasp the meaning of material. This may be shown by translating material from one form to another (word to numbers), by interpreting material (explaining or summarizing), and by estimating future trends (predicting consequences or effects). At the comprehension level, more than rote memorization is required. For example, previously unseen examples cannot be memorized. These learning outcomes go one step beyond the simple remembering of material, and represent the lowest level of understanding.

### Related comprehension level verbs

The following is a list of some of the common comprehension level verbs:

Account for	Distinguish	Generalize	Paraphrase	Reword
Associate	Draw	Predict	Rewrite	Give in own
Change	Estimate	Prepare	Restate	words
Classify	Expand	Show	Put in order	Give examples
Conclude	Explain	Simplify	Compare	Outline
Group	Read	Suggest	Convert	Express in
Covert	Illustrate	Recognize	Demonstrate	other terms
Infer	Rearrange	Summarize	Convert	Reorder
Describe	Extrapolate	Interpret	Reorganize	Determine
Fill in	Measure	Represent	Define	Differentiate

### Typical Tasks at the comprehension level

The comprehension level of learning calls for objectives that require the learner to restate or reorganize material in a literal manner to suggest they understand the meaning. Some typical comprehension level tasks are:

- Give an example
- What will the consequences be...
- What was the author's important idea?
- What caused this?
- Compare things
- Contrast; how are things different?
- Paraphrase
- Rephrase
- Summarize
- Translate

*Continued on next page*

## Level 3—Application

### The application level

Application refers to the ability to use learned material in new and concrete situations. This may include the application of such things as rules, methods, concepts, principles, laws, and theories. Learning outcomes in this area require a higher level of understanding than those under comprehension

### Related application level verbs

The following is a list of some of the common comprehension level verbs.

Apply	Determine	Generalize	Record	Relate
Calculate	(calculate)	Graph	Choose	Develop
Restructure	Classify	Discover	Interpret	Select
Collect	Discuss	Interview	Plan	Show
(information)	Illustrate	Distinguish	Investigate	Practice
Solve	Complete	Predict	Construct	Estimate
Present	Examine	Produce	Expand	Make
Prove(in math)	Convert	Demonstrate	Organize	Put into
Put into action	Put into use	Put together	Track (as in	process)

### Typical tasks at the application level

The application level of learning objectives require learners to use previously learned material to solve problems in new situations. Some typical application level tasks are:

- Solve (a problem)
- Apply the principle (concept) to...
- Compute
- Prepare
- Relate
- Produce
- Modify
- Classify

*Continued on next page*

## Level 4—Analysis

---

**The analysis level** Analysis refers to the ability to break down material into its component parts so that its organizational structure may be understood. This may be a relationship between parts, and recognition of the organizational principles involved. Learning outcomes here represent a higher intellectual level than application because they require an understanding of both the content and the structural form of the material.

---

**Related analysis level verbs** The following is a list of some of the common analysis level verbs.

Analyze	Determine	Examine	Order	Simplify
Break down	Diagram	Formulate	Outline	Sort
Categorize	Differentiate	Examine	Point out	Subdivide
Classify	Discover	Group	Put into	Survey
Compare	Discriminate	Identify	(categories)	Take apart
Contrast	Distinguish	Illustrate	Recognize	Transform
Criticize	Divide	Infer	Relate	Uncover
Debate	Draw	Inspect	Search	
Deduce	(conclusions)	Make	Select	
Detect		(inferences)	Separate	

---

**Typical tasks at the analysis level** The analysis level of learning objectives require the learner to break down an idea into its component parts for logical analysis. Some typical analysis tasks are:

- What reasons does the author give for his conclusions?
  - What does the writer seem to believe?
  - What vocabulary seems to imply bias or emotion?
  - Does the evidence support the conclusion?
  - Break down
  - Distinguish
- 

*Continued on next page*

## Level 5—Synthesis

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**The synthesis level**

Synthesis refers to the ability to put parts together to form a new whole. This may involve the production of a unique communication (a theme or speech), a plan of operations (a research proposal), or a set of abstract relations (scheme for classifying information). Learning outcomes in this area stress creative behaviors, with major emphasis on the formulation of new patterns or structures.

---

**Related synthesis level verbs**

The following are some of the common synthesis level verbs.

Arrange	Derive	Integrate	Present (an	Specify
Blend	Design	Invent	original re-	Suppose
Build	Devise	Make up	port or work)	Summarize
Categorize	Develop	Modify	Produce	Synthesize
Combine	Document	Originate	Propose	Tell
Compile	Explain	Organize	Rearrange	Write
Compose	Form	Perform	Reconstruct	
Constitute	Formulate	Plan	Relate	
Construct	Generalize	Predict	Reorganize	
Create	Generate	Prepare	Revise	
Deduce	Imagine	Prescribe	Rewrite	

---

**Typical tasks at the synthesis level**

The synthesis level of learning objectives require the learner to combine ideas into a statement, plan, product, etc., that is new for them. Some typical synthesis tasks are:

- Develop a model
  - Combine elements
  - Write a speech
  - Create
  - Combine
  - Design
  - Diagram
  - Write
  - Propose
- 

*Continued on next page*

## Level 6—Evaluation

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### The evaluation level

Evaluation is concerned with the ability to judge the value of material (statement, novel, market research report, trend data) for a given purpose. The judgments are to be based on definite criteria. These may be internal criteria (organizational) or external (relevance to the purpose), and the student may determine the criteria given to them. Learning outcomes in this area are the highest in the cognitive hierarchy because they contain elements of all of the other categories, plus conscious value judgments based on clearly defined criteria.

---

### Related evaluation level verbs

The following are some of the common evaluation level verbs.

Appraise	Consider	Determine	Interpret	Standardize
Argue	Contrast	Discriminate	Measure	Summarize
Assess	Criticize	Distinguish	Rank	Support
Award	Critique	Evaluate	Rate	Test
Choose	Decide	Grade	Recommend	Validate
Compare	Defend	Judge	Relate	Verify
Conclude	Describe	Justify	Select	

---

### Typical tasks at the evaluation level

The evaluation level of learning objectives require the learner to judge something based on some criteria. Some typical evaluation level tasks are:

- Evaluate that idea in...
  - Give a reason for or against...
  - Present a rationale...
  - Criticize
  - Justify
  - Assess
  - Appraise
-

## Section Summary

### The three parts of an objective

In this section we have covered what a learning objective is and the purposes of objectives. We have also discovered the three parts of an objective which are summarized in the following table:

Part	Definition	Example
Performance condition statement	Describes the circumstances under which the learner will complete the measurable or observable behavior called for in the performance statement	Given a calculator and cost and pricing data...
Performance (action) statement	Describes what the learner will be “doing” when demonstrating “mastery.” Action statements use a specific verb which clearly and concisely identify an observable or measurable behavior	...the student will calculate the cost of paint...
Performance criterion statement	Describes the quality or quantity standards required for acceptable performance.  A criterion (or standard) may be established using time, speed, accuracy, or quality.	...without errors



## Section References

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### References

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## Appendix D

### Course Management Plan

#### Components of a Course Management Plan

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**Introduction** A management plan is an agreement between the customer (DAU) and the school or contractor development team regarding the parameters for the development of a specific training product or series of products. The management plan is typically the first document developed when support for development of an education and training project is requested. It is usually developed by the course development team.

---

**Content** The management plan contains but is not limited to the following sections:

- Project description
- Development plan
- Resource requirements
- Major milestones and deliverables

Each section is described in more detail below.

---

**Project description** A project description provides information on the:

- Background—what triggered the project, the type of customer need identified such as a performance deficiency or change in a system, and a brief description of major events leading to this point.
- Purpose—an explanation of the intention for this effort.
- Project goals—the specific outcome(s) toward which all work is directed.
- Target audience—a description of the job series or other characteristics of the target population, its location, and size.

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*Continued on next page*

## Components of a Management Plan, Continued

---

### Project description, continued

- Prerequisites—any training requirements that target audience members must complete before participating in the training.
- Products—a list of the goods and services to be produced during the life of the project.
- Assumptions—a list of assumed conditions over which the development team has no control and upon which project milestones are contingent.

The project description may also list of other considerations which are critical to successful project completion such as course delivery, scheduling, instructor certification, and maintenance of technical content.

---

### Development plan

The development plan describes the strategy that will be followed to produce the instruction. This section provides an overview of the instructional design model to be used.

All tasks that will be performed during each phase of the instructional design phase are identified. The deliverables which are produced during each phase are also cross referenced to all tasks identified.

---

### Resource requirements

All personnel required for the project for both the development team and the customer should be listed in this section along with each team member's role and responsibilities. Project positions usually include:

- project manager for the development team
- subject matter experts/authors
- education specialists
- approving/reviewing authorities
- and other special positions required for the specific project.

In addition to personnel, all supplies and equipment required to be purchased for the project should also be listed.

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*Continued on next page*

## **Components of a Management Plan, Continued**

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**Milestones**

The management plan concludes with a schedule listing the milestone dates for all major events in the life of the project. Major events include:

- all activities such as research, data analysis, pilots
- all deliverables such as draft instructor/student guides, audio visual materials, and camera ready copy or floppy disk masters, and
- and in progress review meetings.

---

**Summary**

The course management plan establishes the parameters against which instructional products will be developed. It should include a description, course development plan, resource requirements, major milestones and deliverables.

---



## Appendix E

### Course Design Plan

#### Components of a Course Design Plan

---

<b>Introduction</b>	A course design plan is a blueprint for the specifications of the course to be developed. Typically such a plan is prepared by the development team after analysis of the target audience, job duties/tasks, and content processes.
---------------------	---

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<b>Basis for design</b>	<p>A course design plan</p> <ul style="list-style-type: none"><li>• is based on clearly articulated goals and measurable objectives</li><li>• facilitates learner readiness</li><li>• calls for a stimulating learning environment.</li><li>• focuses on the critical outcomes identified.</li><li>• is learner centered.</li></ul>
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---

<b>Design plan contents</b>	<p>A course design plan contains but is not limited to the following:</p> <ul style="list-style-type: none"><li>• Assumptions—all requirements which weren't previously listed in the management plan which if not met would impact on the quality or timeliness of the instruction produced.</li><li>• Course map—sequential listing of all topics covered along with a rationale for the sequence.</li><li>• Detailed descriptions for each unit, module, or lesson.</li></ul>
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*Continued on next page*

## Components of a Course Design Plan, Continued

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### Detailed descriptions

Detailed descriptions of each unit or lesson of instruction are important to ensure the customer and the developer have agreement on the content and methods for learning to be emphasized throughout each section of the training. Such a description usually includes:

- A listing of all terminal and enabling objectives
  - Critical teaching points for learning activities
  - Methods of instruction for each TLO/ELO and teaching point
  - A description of the learning activities
  - A summary of the assessment methods to be utilized to provide student feedback on mastery of critical outcomes
- 

### Elements for design consideration

The following should be taken into consideration when preparing a course design:

- Does the design provide options for a variety of learning methods?
  - Does the design encourage interaction for
    - students to students (one on one & small groups)?
    - students to subject matter content?
    - students to instructors?
  - Does the design provide adequate learner feedback on mastery of course objectives?
  - Does the design encourage active learning ?
- 

### Summary

The course design plan is used as the blueprint for specifications of the course to be developed. It should include course assumptions, a sequential listing of topics and detailed descriptions of each unit.

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## Appendix F

### Instructor Preparation

#### Overview

---

##### Introduction

Section 5, Development provides an overview of the types of instructional support materials needed for the conduct of a course. It is not all-inclusive, nor is intended to prescribe a specific approach; it is merely illustrative. The DAU Policy Memorandum #1 - *New Course Development, Revision, and Maintenance* -also lists the components of each required document.

---

##### In this section

This section provides templates and examples of the following:

Topic(s)	See Page
Components of a Lesson Plan	F-2
Checklist for Lesson Plan Development	F-4
Instructor Presentation	F-5
Appendix Summary	F-10

---



## Components of a Lesson Plan

---

**Course Title** Write the full the name of your course in this section.

---

**Lesson Title** Write the name of the specific lesson in this section.

---

**Time required** Include the specified time in this section. Include hours and minutes (e.g. 1 hour and 30 minutes).

---

**Objectives** Include both the terminal (TLO) and enabling objectives (ELOs):

TLO: Given “X” (state the conditions of performance), Do “Y” (state the behavior), so that “Z” (state the standard of performance).

Enabling	Performance Statement
ELO #1	Statement
ELO #2	Statement
ELO #3	Statement
ELO #4	Statement
ELO #5	Statement

Note: List all enabling objectives in sequence.

---

*Continued on next page*

## Component of a Lesson Plan, Continued

### Instructional Aids

List all support materials needed for the lesson:

Type	Description or Identification
Slides	ID Number
Overheads	ID Number
Handouts	Describe
Video	Name
Equipment	Overhead projector Flipchart TV/VCR Computer
Other	Any special items

Note: List all items the instructor(s) must have in order to present the lesson.

### Student Preparation

State what the student must accomplish before participating in this lesson. Prerequisites of any courses, classes, qualification, pre-course or homework, etc. required prior to beginning this instruction.

### Presentation Method

List all methods used to deliver learning, i.e., case study, lecture, group discussion, role-play, etc.

### Evaluation Methods

State whether students will be required to take a written exam, pass a performance quiz, participate in a graded group or individual exercise, etc., and to what standard, i.e., *with 80% accuracy*.

### Notes to Instructor

Describe the background of the lesson and identify any actions the instructor must take to prepare for this lesson, i.e., *prepare in advance the chart used during the role play exercise on page...or, review the article about recent changes in acquisition...*

*Continued on next page*

## Lesson Plan, Continued

Developer's Name: _____ Date: _____				
Organization or Department: _____				
Lesson Title: _____				
Item	Yes	No	Suggestions for Changes	Notes
1. COVER SHEET COMPLETE				
2. OBJECTIVES				
A. Based on analysis				
B. Complete				
C. Measurable				
3. INTRODUCTION				
A. Objectives presented				
B. Reason for study				
C. Tied to past learning				
4. LESSON CONTENT				
A. Consistent with objectives				
B. Sequenced for learning				
C. Clear, consistent structure				
D. Summary provides review				
1. LEARNING METHODS				
A. Matched to an objective				
B. Student involvement assured				
1. PRESENTATIONAL STRATEGIES				
A. Key questions				
Examples, analogies, etc.				
C. Instructional aids				

## Instructor Presentation

---

**Introduction**      The goal of the lesson introduction is to provide focus, motivation, attention, and preparation for the students to assist in the learning process. The following are suggestions, based on current educational research, of elements that should be included in the introduction to a lesson.

---

**Section one**      **A. Preliminaries**

1. Lesson Title.
  2. Student Materials.
  3. State your name and provide a brief background, as applicable.
  4. Student comfort: Ensure the environment is comfortable *and conducive to learning* with attention to lighting, temperature, noise, AV equipment, etc.
  5. Solicit class participation: Let students know they are welcome and encouraged to ask questions during any part of the lesson. Inform them of any special requests such as raising hands to participate, setting pagers to vibrate, etc.
- 

**A. Tie-in or Review of Previous Lessons**

1. Stimulate the recall of previous learning and relate it to new information.
  2. Ask review questions.
- 

**A. Preview Learning Objectives**

1. Terminal: Address the learning objectives in clear, concise language; and if necessary, illustrate them in a variety of ways for clarification.
  2. Enabling: Explain the enabling objectives and how they relate to the *mastery* of the terminal objective.
- 

*Continued on next page*

## Instructor Presentation, Continued

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### Section one, continued

#### A. Motivator

1. Attention Getter: Prepare the mind of the learner by attracting attention, arousing curiosity, creating interest and a desire to learn.
  2. Ask questions, give examples, tell of personal experiences; create some type of interesting reason for study --WIIFM: What's In It For Me?
- 

### Presentation

The purpose of the presentation is to present new ideas, provide instructions, and reinforce previously learned information. The presentation provides the lesson content, as well as student and instructor activities.

---

### Section Two

#### A. Present the Learning Material

1. Present statements of new information in meaningful context, logical sequence, and chunked or grouped into small, manageable blocks, each of which covers one main point or idea centered around the enabling objective. Expand each main content area into organized, complete thoughts.
- 

#### B. Transition

1. Use clear, concise transitions when moving from one topic ((enabling objective) to the next.
  2. Provide periodic reviews or internal summaries.
- 

#### C. Present the Next Section's (topic/ELO #2) Learning Materials

1. Overview.
  2. Details.
  3. Practice, as appropriate, for this enabling objective.
- 

#### D. Repeat above as necessary for each enabling objective and topic area.

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*Continued on next page*

## Instructor Presentation, Continued

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### Write so that others may teach

Text material in the content outline should have sufficient detail so that another qualified instructor can deliver the instruction as intended without having to “read” the content to the students. In other words, write the lesson plan for a substitute instructor.

---

### Incorporate Methods

Instructional aids, group activities, and other involvement exercises and experiences should be incorporated in the content section and within the structure of the presentation.

For example, with the use of computers, graphic icons can be included as cues to help visually recognize instructional intent. The icon below could be used to indicate the lecture mode.

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This graphic is an example using Microsoft Word, but other graphics are readily available.

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*Continued on next page*

## Instructor Presentation, Continued

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<b>Application</b>	The application (or practice) section gives the students practice in applying knowledge, skills, and attitudes. It also helps facilitate retention of materials or skills learned.
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### Section Three

#### **A. The Application of Learning**

1. The lesson plan does not have to have a special heading entitled, “APPLICATION.” However, it does have to include some type of activity/exercise/assignment that provides students with practice.
2. Conduct some type of learning activity, with written clear directions, to ensure the students understand and can use the material presented
  - a. Ask Questions: Pre-prepared questions are written into the lesson plan (the “ideal” answer may be placed in the right column.
  - b. Conduct an Exercise:
    - Brainstorm
    - Facilitate a group discussion
    - Provide a demonstration
    - Use written instruction sheets
    - Role play
    - Use a case study
    - Be creative as time permits
3. Provide time for repetition and rehearsal of the information, concept, Principle, etc.

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*Continued on next page*

## **Instructor Presentation, Continued**

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<b>Provide closure to the lesson</b>	A summary that highlights the important points and provides a review of the learning objectives is essential for every lesson plan.
--------------------------------------	---

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### **Section Four**

#### **A. Review the Main Points**

1. To determine the extent of the students' learning.
  2. To determine the efficiency and effectiveness of instruction.
  3. To aid in retention and help reinforce what has been learned.
- 

#### **B. Restate Lesson Objectives**

1. To make sure the students have accomplished the terminal and enabling objectives.
  2. To ensure that all of the objectives has been adequately absorbed by the learner.
- 

#### **C. Answer Any Remaining Questions**

---

#### **D. Tie to Next Lesson**

1. Prepare an advanced organizer, or point ahead to let students know what is coming up.
-



## **Appendix Summary**

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### **Appendix Summary**

In Appendix F, we have provided a sample lesson plan outline. We have also included suggested elements that faculty need to include in a well-prepared lesson. A review of the lesson plan requirements would suggest that it favors learning over instructing. Follow the guidelines provided in this appendix and you will insure a robust learning experience for your students.

---

## Appendix G

### Test and Assessment: Planning And Writing

#### Overview

#### Introduction

Section VI of the *Guide*, Evaluating Student Performance introduced various types of tests and assessments that can be used in performance-based, instructional designs. Appendix G takes a more prescriptive approach and focuses on the construction of student achievement tests. It will emphasize those principles and procedures of test construction that are most useful in classroom instruction.

#### In this appendix

Appendix G covers the following topics.

Topic	See Page
Method for Deciding the Type of Test or Assessment	G-2
Advantages and Disadvantages of Various Test and Assessment Items	G-5
Multiple Choice	G-5
Alternative Choice	G-6
Matching	G-7
Completion/Fill-In	G-8
Essay/Short Answer	G-9
Critical Incident/Practical Exercise	G-10
Simulation/Role Play	G-11
Case Study	G-12
Guidelines for Developing Test and Assessment Items	G-13
Multiple Choice	G-14
Alternative Choice	G-16
Matching	G-17
Completion/Fill-In/Short Answer	G-18
Essay	G-19
Case Studies	G-20
Critical Incident	G-21
Incident Process	G-22
Practical Exercise	G-23
Simulation	G-24
Role Play	G-26
Item Analysis of Criterion-Referenced Tests	G-28
Summary	G-32
References	G-33

## Methods for Deciding the Type of Test or Assessment

---

### Introduction

Deciding which type of test or assessment item to use can be perplexing. While there are no really hardcore rules to follow, sound judgments can be made by considering whether or not you want to test performance objectives for

- acquiring knowledge
  - practicing knowledge, or
  - practicing performance.
- 

### Acquiring knowledge

Acquiring knowledge (AK) tests to determine if the student has gained new information or knowledge. This involves testing for

- facts or concepts
  - recognizing or discriminating between alternatives
  - steps in procedures
  - rules or principles, and/or
  - conditions of performance (when, where, or how).
- 

### Samples of testing for knowledge

The following are examples of testing for knowledge.

<i>Example 1</i>	List three facts necessary to establish distribution of assets by a transfer corporation.
<i>Example 2</i>	Distinguish between criterion-referenced and norm-referenced grading systems.

---

### Practicing knowledge

Practicing knowledge (PK) tests to see if the learner can apply knowledge in a job-related situation, although in smaller, very structured pieces. This involves testing for making decisions, and applying decisions to situations.

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*Continued on next page*

## Methods for Deciding the Type of Test or Assessment, Continued

### Samples of testing knowledge

The following are examples of testing of practicing knowledge.

<i>Example 1</i>	After receiving the details of a transfer of assets, determine whether property was transferred for less than full and adequate considerations <i>after, or at the same time</i> a tax liability was accrued.
<i>Example 2</i>	Using the test items and objectives provided, revise the items to follow criterion test item guidelines.

### Practicing performance

Practicing performance (PP) tests the student's ability to use knowledge and skills acquired in a job situation, or in the closest approximation of job conditions. This involves

- performing the job using knowledge and skills learned, and
- applying rules, principles, and facts in solving simulated job problems.

### Samples of testing performance

The following are examples of testing for performance.

<i>Example 1</i>	With the data provided, prepare a statement of the transferor's of assets and liabilities as of the date of transfer. Your statement must include (a) market value of assets; (b) exclusion of assets from transferred, levied, and partially owned property, and; (c) accrued and assessed taxes plus penalties and interest as part of liabilities.
<i>Example 2</i>	Using the objectives provided, develop appropriate test items.

*Continued on next page*

## Methods for Deciding the Type of Test or Assessment, Continued

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**Associated types  
of test and  
assessment items**

The following are associated types of tests and assessments for acquiring knowledge, practicing knowledge, and practicing performance.

<b>If you want to test for . . .</b>	<b>Then use . . .</b>
acquiring knowledge	multiple choice alternative choice matching completion/fill-in short answer, or essay.
practicing knowledge	multiple choice case study critical incident incident essay practical exercise, or role play.
practicing performance	on-the-job setting practical exercise case study role play, or simulation.

---

## Advantages and Disadvantages of Test and Assessment Items

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**Introduction** All of the various tests and assessments in this *Guide* have both advantages and disadvantages.

---

**What you should consider** You should consider each of the advantages, and especially the disadvantages, of using specific test or assessment devices before making a decision on which to use.

---

**Multiple choice** Here are the advantages and disadvantages of multiple choice test items.

Advantages	Disadvantages
<ul style="list-style-type: none"><li>• Requires short periods of reading and response time, allowing the instructor to cover more content.</li><li>• Provides objective measurement of student achievement or ability.</li><li>• Provides highly reliable test scores.</li><li>• Provides scoring efficiency and accuracy.</li></ul>	<ul style="list-style-type: none"><li>• Provides difficulty in measuring learning objectives requiring more than simple recall or recognition of information.</li><li>• Difficult to construct due to the problem of selecting a common set of stimuli and responses.</li></ul>

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*Continued on next page*

**Advantages and Disadvantages of Test and Assessment Items, Continued**

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**Alternative  
choice**

Here are the advantages and disadvantages of alternative choice test items.

<b>Advantages</b>	<b>Disadvantages</b>
<ul style="list-style-type: none"><li>• Can provide the widest sampling of content or objectives per unit of testing time.</li><li>• Scoring is efficient and accurate.</li><li>• Versatility in measuring several levels of cognitive ability.</li><li>• Can provide highly reliable test scores.</li><li>• Provides an objective measurement of student achievement or ability.</li></ul>	<ul style="list-style-type: none"><li>• Incorporates an extremely high guessing factor; student could have a 50/50 chance of correctly answering the item without any knowledge of the item's content.</li><li>• Can often lead a test-developer to write ambiguous statements due to the difficulty of writing statements which are unequivocally true or false.</li><li>• Items do not discriminate between students of varying ability as well as other item types.</li><li>• Can often include more irrelevant clues than do other item types.</li><li>• Can often lean a test-developer to favor testing trivial knowledge.</li></ul>

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*Continued on next page*

## Advantages and Disadvantages of Test and Assessment Items, Continued

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**Matching items**      Here are the advantages and disadvantages of matching test items.

Advantages	Disadvantages
<ul style="list-style-type: none"><li>• Requires short periods of reading and response time, allowing the instructor to cover more content.</li><li>• Provides objective measurement of student achievement or ability.</li><li>• Provides highly reliable test scores.</li><li>• Provides scoring efficiency and accuracy.</li></ul>	<ul style="list-style-type: none"><li>• Provides difficulty in measuring learning objectives requiring more than simple recall of information.</li><li>• Difficult to construct due to the problem of selecting a common set of stimuli and responses.</li></ul>

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*Continued on next page*



## Advantages and Disadvantages of Test and Assessment Items, Continued

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**Completion/fill-in** Here are the advantages and disadvantages of completion/fill-in test items.

Advantages	Disadvantages
<ul style="list-style-type: none"><li>• Can provide a wide sampling of content.</li><li>• Can efficiently measure lower levels of cognitive ability.</li><li>• Can minimize guessing as compared to multiple-choice or true-false items.</li><li>• Can usually provide an objective measure of student achievement or ability.</li></ul>	<ul style="list-style-type: none"><li>• Difficult to construct so that the desired outcome response is clearly indicated.</li><li>• Difficulty measuring learning objectives requiring more than simple recall of information.</li><li>• Can often include more irrelevant clues than do other item types.</li><li>• More time consuming to score when compared to multiple-choice or true-false items.</li><li>• More difficult to score since more than one answer may have to be considered correct if the item was not properly prepared.</li></ul>

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*Continued on next page*

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## Advantages and Disadvantages of Test and Assessment Items, Continued

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**Essay/short  
answer**

Here are the advantages and disadvantages of essay and short answer test items.

Advantages	Disadvantages
<ul style="list-style-type: none"><li>• Easier and less time consuming to construct than are most other item types.</li><li>• Provide a means for testing the student's ability to compose an answer and present it in a logical manner.</li><li>• Can efficiently measure higher order cognitive objectives: analysis, synthesis, and evaluation.</li></ul>	<ul style="list-style-type: none"><li>• Cannot measure a large amount of content objectives.</li><li>• Generally provides low test and test-scorer reliability.</li><li>• Requires an extensive amount of instructor's time to read and grade.</li><li>• Generally does not provide an objective measure of student achievement or ability (subject to bias on the part of the grader).</li></ul>

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*Continued on next page*

## Advantages and Disadvantages of Test and Assessment Items, Continued

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**Critical incident, incident, or practical exercise**

Here are the advantages and disadvantages of critical incident, incident, and practical exercise assessment items.

Advantages	Disadvantages
<ul style="list-style-type: none"> <li>• Minimizes guessing by requiring students to provide an original response.</li> <li>• Easier to construct than multiple-choice or matching items.</li> <li>• Can most appropriately measure learning objectives which focus on the ability to apply skills or knowledge in the solution of problems.</li> <li>• Can measure an extensive amount of content objectives.</li> </ul>	<ul style="list-style-type: none"> <li>• Generally provides low test and test scorer reliability.</li> <li>• Requires an extensive amount of instructor time to read and grade.</li> <li>• Generally does not provide an objective measure of student achievement or ability (subject to bias on the part of the grader when partial credit is given).</li> </ul>

*Continued on next page*

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## Advantages and Disadvantages of Test and Assessment Items, Continued

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**Simulation and  
role play**

Here are the advantages and disadvantages of simulation and role playing assessment items.

Advantages	Disadvantages
<ul style="list-style-type: none"><li>• Can most appropriately measure learning objectives which focus on the ability of the student to apply skills or knowledge in real-life situations.</li><li>• Usually provide a degree of test validity not possible with standard paper and pencil items.</li><li>• Useful for measuring learning objectives in the Psychomotor Domain.</li></ul>	<ul style="list-style-type: none"><li>• Difficult and time-consuming to construct.</li><li>• Primarily used for testing students individually and not for groups. Consequently, they are relatively costly, time-consuming, and inconvenient forms of assessment.</li><li>• Generally provide low test and test scorer reliability.</li><li>• Generally do not provide an objective measure of student achievement or ability (subject to bias on the part of the observer/grader).</li></ul>

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*Continued on next page*

## Advantages and Disadvantages of Test and Assessment Items, Continued

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### Case study

Here are the advantages and disadvantages of the case study as assessment items.

Advantages	Disadvantages
<ul style="list-style-type: none"><li>• Provides a method for students to apply cognitive ability to real life situations.</li><li>• Can assess cognitive objectives and using analysis, synthesis, and evaluation.</li><li>• Can be used as a needs assessment tool to identify areas for learning.</li><li>• Can individualize instruction using small group processing techniques.</li></ul>	<ul style="list-style-type: none"><li>• Difficult to construct realistic well integrated case studies.</li><li>• Requires a skilled facilitator to ensure meaningful and useful feedback.</li><li>• Generally does not provide an objective measure of student achievement or ability.</li><li>• Subject to grader bias. Bias can be minimized by determining criteria for scoring ahead of time.</li></ul>

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## Guidelines for Developing Test and Assessment Items

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### Introduction

Once you have selected the type item you will use to test or assess your objective(s), there are some guidelines that are helpful in constructing valid and reliable question. This section of appendix G provides guidelines for developing the various types of test and assessment items.

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### FYI

Just as a reminder, we included some guidelines for selecting test and assessment techniques in Section 6 Evaluation: Student Performance of this *Guide*. It might be helpful for you to cross-reference that list as you follow the guidelines provided here.

Topic You Probably Should Review	On Page
Guidelines for Selecting Test or Assessment Techniques	VI-8

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*Continued on next page*

## Guidelines for Developing Test and Assessment Items, Continued

### Guidelines for using multiple choice items

The following guidelines should be used when constructing multiple-choice test items.

- ✓ The stem should contain a central problem.
- ✓ The question as a whole should be realistic and practical. It should not be academic and artificial.
- ✓ It should deal with an important and useful aspect of the job. It should not deal with trivial details and useless information.
- ✓ It should present a problem that requires knowledge of the job or of the instruction. Questions that can be answered on the basis of intellect or general knowledge alone should not be included in a test.
- ✓ Each question should be an independent problem and should not reveal the answer to another question.
- ✓ The problem should contain only material relevant to its solution (unless selection of what is relevant is part of the problem).
- ✓ Do not include choices that are trivial, implausible, or obviously incorrect. The distractors (wrong answers) should be plausible answers representing common errors and misconceptions.
- ✓ The best answer should not be given away by irrelevant details. Avoid clues to the correct answer.
- ✓ When a negative word is used in the stem, the negative word or phrase should be emphasized. Negative words should also be checked to be certain that a double negative has not been used. When a negative is used in the stem, a negative should not appear in the alternatives.
- ✓ Choices that are numerically or logically related in a sequence should be placed in proper order.

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## Guidelines for Developing Test and Assessment Items, Continued

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### Guidelines for developing multiple choice, continued

The checklist for developing multiple-choice test items is continued below:

- ✓ Place the choices at the end of the statement. Do not use blank spaces in the stem. This makes for continuity of reading and is less confusing for the student.
- ✓ Words or phrases common to all alternatives, should be placed in the stem.
- ✓ “All of the above” or “None of the above” alternatives:
  - Should be used ONLY when they can meet a bona fide requirement for testing against an absolute standard of correctness or incorrectness. These choices may have application in the one correct answer variety of multiple choice items, but are inappropriate in best answer items.
  - Should not be used merely to provide another alternative in a multiple choice item when the test-writer has difficulty in writing the required number of choices.
  - If used, should not be used together. When one of these option-type of alternatives is appropriately used in a test item, the other should not be used. The situations in which both “*none of the above*” or “*all of the above*” might represent logical and challenging choices in a requirement are so remote than it is best not to consider their use together.
  - Are tempting to over utilize as the correct response. When using either, be careful not to always make [it] the correct response.

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## Guidelines for Developing Test and Assessment Items, Continued

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### Guidelines for using alternative choice items

The following guidelines should be used when constructing alternative choice test items.

- ✓ Compile a list of significant true statements and reword about half of them to make them false.
- ✓ Phrase the statements so as not to quote verbatim from the lecture or text.
- ✓ Make statements definite and clear.
- ✓ Make statements brief and of about the same length. A frequent mistake is to unconsciously make the true statements longer than the false ones.
- ✓ Be careful with specific determiners. Whenever words are used such as "no, never, always, should, all, and only," be sure that they do not make correct answers obvious.
- ✓ Avoid trick questions. Do not contrive items that endeavor to catch the student unaware.
- ✓ When possible, make the crucial element come near the end of the statement.
- ✓ Avoid words which are open to interpretation such as few, large, small, average, etc.

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## Guidelines for Developing Test and Assessment Items, Continued

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### Guidelines for developing matching items

The following guidelines should be used when constructing matching test items.

- ✓ Make at least 5 (and rarely more than 12) responses in completing a matching exercise. Responses are placed in the column on the right which is usually column B.
- ✓ Include at least three plausible responses from which each correct responses may be selected. If this requires too many choices in the right-hand column, it indicates that the material included in the exercise is not sufficiently related for use in this type of test item. Only homogeneous or related materials can be effectively used in matching exercises.
- ✓ Write directions so that the student knows whether to use items in the right-hand column more than once or only once.
- ✓ Set up the test so that the complete matching exercise appears on one page.
- ✓ Assign a value to each correct response that is equal to the value of multiple choice items used in the test.
- ✓ Use the first item as an example and relate the example to the entire matching exercise. Also use a title at the head of each column.
- ✓ Write the directions to fit the specific matching exercise.

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## Guidelines for Developing Test and Assessment Items, Continued

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### **Guidelines for developing completion, fill-in, or short answer items**

The following guidelines should be used when constructing completion, fill-in, or short answer test items.

- ✓ Select and state the questions in such a way that they can be answered with a word or a short phrase.
- ✓ Select and phrase the questions so that only one or a very few answers will be correct.
- ✓ Prepare enough questions to adequately determine if the students have attained the objectives.
- ✓ Do not provide optional questions.

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## Guidelines for Developing Test and Assessment Items, Continued

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### Guidelines for developing essay items

The following guidelines should be used when developing essay-type test items.

- ✓ Essay questions should be used when the objective requires the student to demonstrate an understanding of complex relationships which cannot be represented in matching, true-false, short answer or the other more concrete types of items.
- ✓ The essay question should pinpoint a specific relationship the student is to explain, rather than asking for essentially everything he or she knows about the topic.
- ✓ The test author should provide the test grader with specific criteria, or a checklist of key points which the essay should include, even if the test author and grader are the same person. This checklist minimizes the subjective evaluation of essay answers.

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## Guidelines for Developing Test and Assessment Items, Continued

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### Guidelines for developing case studies

The following guidelines should be used when developing case study assessment items.

- ✓ Case studies should be used where there is data to analyze but no conflict. Where the situation involves conflict, use a role play or, if the dramatic crux of the case is short, a critical incident item. Where the objective calls for oral communication, use a role play instead of a case study, even if there is no conflict in the situation.
- ✓ Whenever possible, keep narrative to a minimum and present the case through realistic documents and briefly stated facts on which to base decisions and actions.
- ✓ Clearly specify what decisions and actions are expected of the student, including any forms they are to fill out.
- ✓ Provide all facts necessary to solve the problem(s), along with enough generally related but unnecessary information to give the student practice in sorting relevant from irrelevant data while solving the problem.
- ✓ If used in small groups, the case study must include clear assignments for the group and clear instructions for reporting back to the larger group.
- ✓ Include an ambiguous ending that stimulates problem-solving.
- ✓ If there are only one or two correct answers to the problem, such as a form with all information correctly computed and filled out, the test author should provide the answer key. If a number of different answers are acceptable, the test author should provide some rating sheet or list of minimum elements included in an acceptable answer. Otherwise, the instructor should be available to give personal feedback in as unbiased a manner as possible on case study answers.

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## Guidelines for Developing Test and Assessment Items, Continued

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### Guidelines for developing critical incidents

The following guidelines should be used when developing critical incident assessment items.

- ✓ Critical incident items must be short.
- ✓ Critical incident items must concretely describe a situation that includes a conflict or problem to which the student would have to react quickly on the job. The description should be clear enough so that the student can picture it and him or her taking action.
- ✓ For administrative ease, the student can be asked to describe his or her action in writing.
- ✓ As with essay questions, the test writer should provide the test grader with a checklist or key points to look for that will minimize the subjective evaluation of the answer(s).

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## Guidelines for Developing Test and Assessment Items, Continued

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### Guidelines for developing exercises practical

The following guidelines should be used when developing practical exercises as assessment items.

- ✓ The practical exercise must be easy to administer in a relatively short time. In most cases, the amount of time that can be allotted to formal testing is quite limited. Students must be exposed to the concepts and be given a chance to practice them before tests are administered. If the tests are too time consuming, they will take up class time that should be devoted to other teaching and learning activities. Also, an excessively long test may measure endurance rather than mastery. After 2 or 3 hours students get tired and cannot do work that shows all they have learned.
- ✓ The format and directions should be easy to follow. This makes the test easy to administer and conserves the student's time and energy.
- ✓ The practical exercise should extract the most critical elements of the task or objective. Select the critical elements on the basis of their importance, frequency, and difficulty. A practical exercise is much more selective than a simulation. In a simulation a student may be required to go through the entire process of preparing a written document; whereas in a practical exercise the student is asked to prepare the most critical elements of the document. In constructing the exercise, try to include a representative sample of the critical elements.
- ✓ The practical exercise should be presented in a format that simulates job conditions. In presenting the material in this manner, the probability of evaluating relevant job behaviors is increased. Moreover, the value of the test as a teaching device is enhanced. The more frequently a student encounters a job behavior in the classroom, the more able the student will be to cope with the situation on the job.
- ✓ All the materials required by the objective must be supplied to the students.

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## Guidelines for Developing Test and Assessment Items, Continued

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### Guidelines for practical exercises, continued

The guidelines for developing practical exercises are continued from the previous page.

- ✓ The practical exercise should provide a scheme for weighting each critical element. The procedures for weighting should be based on the relevance of the element to the objective; i.e., its importance, difficulty, and frequency. Assigning a numerical weight to each element makes it possible to quantify the results. The test score will be less dependent upon the person grading the exercise.
- ✓ A minimum acceptable score or standard should be established for each practical exercise or test item. If a student falls below that standard, he or she *has not* met the criterion for this particular objective. He or she should be given remedial training to be able to perform at the minimum acceptable level.

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## Guidelines for Developing Test and Assessment Items, Continued

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### Guidelines for developing simulations

The following guidelines should be used when developing simulation assessment items.

- ✓ Be sure the simulation is the best evaluation method for the training situation.
- ✓ Determine the primary learning behavior. Refer back to the learning objective for the simulation and decide which of the following four primary learning behaviors the simulation will focus on.
  - *Discrimination and Decision-Making*—focusing on essential differences in objects or situations; weighing factors which make certain choices preferable.
  - *Problem-Solving*—analyzing or diagnosing a problem to locate its cause and take appropriate action.
  - *Explaining or Public Communication*—communicating clearly and precisely, as well as according to [departmental/organizational] practices.
  - *Effecting Attitudinal or Emotional Change*—including increase or decrease in anxiety, frustration, or other feeling toward a situation.

*Note:* Once you have identified the primary learning behavior, in all subsequent steps try to provide as many opportunities as possible for students to respond using that category of behavior.

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## Guidelines for Developing Test and Assessment Items, Continued

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### Simulation guidelines, continued

The guidelines for developing simulations as assessment devices is continued from the previous page.

- ✓ Design an analytical model of the simulation. Although there are many ways of designing an analytical model, the three steps below provide an easy approach to design one:
  - List in sequential order all steps an employee performs as part of the task or job to be simulated.
  - Underscore all critical steps
  - List all decision-making or critical steps
- ✓ Specify the presentation specifications (stimulus/response/feedback sequences) for each activity or phase of the simulation.
- ✓ Design the simulation activities to represent each major task.
- ✓ Make sure instructions and procedural guidelines of the simulation are clear. This includes writing instructions to tell participants whether the simulation is competitive, how they will know when a round is over, what length of “real world” time the compressed time of the simulation represents (e.g., one round = 1 week on the job), etc.
- ✓ Review the written parts of the simulation.

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## Guidelines for Developing Test and Assessment Items, Continued

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### Guidelines for developing role play

The following guidelines should be used when developing role play assessment items.

- ✓ There should be a broad range of human problems, participants should be given the opportunity to perform effectively, if the intent is to develop skills.
- ✓ It is best to use simulation problems *before* attempting use real organizational problems.
- ✓ Develop clear concise and highly focused materials for participants. Materials should be readable and not too lengthy, or too complicated for a participant to remember.
- ✓ Include some hints on how to play the role.
- ✓ Provide observer background data sheets to the “audience.”

## Item Analysis of Criterion-Referenced Tests

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### Introduction

Whether administered before, during, or after instruction, a test that measures *carefully written objectives* is called a criterion-referenced test.

Criterion-referenced tests are designed to describe which learning tasks a student can and cannot *perform* rather than to discriminate among students. This, of course, represents a huge departure from the traditional use of norm-referenced grading systems by DoD schools.

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### Very different approach

The approach of the commonly used norm-referenced testing may be familiar, even comfortable, but not very useful for criterion-referenced tests. That is because the traditional indexes of item difficulty and item discriminating power are of little value using norm-referenced testing.

For example, a set of items in a criterion-referenced mastery test might be answered correctly by all students (giving it zero discriminating power) and still be effective items. With norm-referencing, if no student ever missed a test item, we would consider it to be inferior.

In criterion-referencing, if test items closely match an important learning outcome, the results simply tell us that *here is an outcome that all students have mastered*.

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### Some Reality

Reality would suggest that most DAU course developers and offerors do not have the appropriate resources to engage in testing and test item analysis as it is supposed to be conducted using criterion-referenced designs; even with the use of computers.

DAU is not in a position to recommend any single type of software. We do recommend searching for a product that will best accommodate individual need and complexity for the type of item analysis required for the instructional design of the course.

Based on our experience with the DAU consortium schools, we will offer a couple of suggestions for item analysis here in appendix G. Course managers and faculty are advised that these are only *suggestions*.

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## Item Analysis of Criterion-Referenced Tests, Continued

**Basic concerns**

One of the basic concerns in evaluating items in a criterion-referenced *mastery* test is the extent to which each item is *measuring the effects of instruction*.

If a test item can be answered correctly by all students *before* and *after* instruction, the item obviously is not measuring instructional effects.

While the above is an extreme example, it highlights the importance of obtaining a measure of instructional effects as one basis for determining item quality.

Note:  
Information in the next two blocks pertains to courses that use pre- and posttests.

**Measuring the effect of instruction**

To obtain a measure of item effectiveness based on instructional effects, the same test *must* be given before and after instruction. Effective items will be answered correctly by a larger number of students after instruction than before.

An index of *sensitivity to instructional effects* can be computed by using the following formula:

$$S = R_A - R_B \div T$$

$R_A$  = the number of students answering the item correctly *after* instruction

$R_B$  = the number answering the item correctly *before* instruction

$T$  = the total number answering the item both times.

Applying this formula to an item that was answered incorrectly by all students ( $N = 32$ ) before instruction and correctly by all students after instruction, our result would be as follows:

$$S = R_A - R_B \div T \quad \text{becomes} \quad S = 32 - 0 \div 32 = 1.00$$

Thus, the maximum sensitivity to instructional effects is indicated by an index of 1.00. The index for effective test items will fall between .00 and 1.00, with larger positive values indicating items with greater sensitivity to the effects of instruction.

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## Item Analysis of Criterion-Referenced Tests, Continued

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### The reporting grid

Another method of item analysis, and perhaps a more utilitarian approach in performance-based training designs, is to cross-reference *each student* against the test or assessment items relative to specific objectives.

A simple reporting grid with the student names listed on one axis and the terminal objectives listed on the other would be sufficient (a sample is on the following page). The individual responses to test items associated with the terminal or enabling objective indicated on the grid would be noted as pass or fail, mastery or non-mastery based on a predetermined level of acceptance.

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### Predetermining the level of mastery

Mastery or non-mastery, pass or fail levels of acceptance must be *predetermined*. Here is an example of how that might work.

- Whereas a terminal objective is keyed to test items 3, 4, 6, and 10, and has a *predetermined level of mastery* of three out of four items must be answered correctly.
  - Then, if student A answers items 3, 6, and 10 correctly, but misses item 4, he or she would still have *mastered* the terminal objective.
  - But, if student B answers items 6 and 10 correctly, but misses items 3 and 4, he or she will have *failed to master* the terminal objective.
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### Using the grid

Keeping track of students and test items is not as difficult as it seems. Setting up a simple grid allows the teacher to track the progress of each student relative to the terminal objectives being tested.

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## Item Analysis of Criterion-Referenced Tests, Continued

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**Sample grid:  
mastery or non-  
mastery**

The following is an example of a tracking grid. Several variations are possible, but the concept is the same: the need to test and report criterion-referenced test data for each student on each objective.

**Student**

**A**  
**B**  
**C**  
**D**  
**E**

<b>Objective 1</b>	<b>Objective 2</b>	<b>Objective 3...</b>
Yes	No	Yes
Yes	Yes	Yes
Yes	No	No
No	Yes	Yes

**If you don't  
remember  
anything,  
remember . . .**

A very important point to remember when using criterion-referenced testing is that the test results on individual objectives **are not** averaged.

That is, outstanding performance on one objective **cannot** make up for poor performance on others. Ergo, the individual areas of non-mastery are easily identified.

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## Item Analysis of Criterion-Referenced Tests, Continued

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**Strategic points  
of analysis**

By representing individual student data in the method described using the sample grid above (or in a similar manner), a number of important points can be analyzed.

- Class totals on the individual objectives can indicate curricula or instructional problems, i.e., objectives where only a few students were successful might indicate a need to enhance the instruction or an objective where all students were successful might indicate that an area of instruction is *not* needed.
  - To the extent that what we want in the way of group performance differs from what we actually get, we have a curriculum problem of some type. This aggregate data allows a better job of managing the curriculum.
  - By ranking the students on the basis of total number of objectives achieved, rather than simple numeric scores, student *mastery* can be identified and rewarded.
  - Finally, the total number of items which must be successfully completed to “pass” a given terminal objective can be set using factors such as the *criticality* of the subject matter as a basis, thus giving the certification of *student mastery* in a specific job or occupation real meaning.
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## Summary

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### Summary

Appendix G has provided guidance about the advantages and disadvantages of using various test and assessment items. Guidelines for developing the different types of tests and assessments has been covered, with checklists provided. Methods for test item analysis were also covered.

*Good* test and assessment instruments provide *good* data for analysis. Effective criterion-referenced test instruments have the characteristic of all types of tests: they are valid and reliable.

Additionally, good criterion-referenced tests must be objective, comprehensive, and capable of differentiating; that is, capable of separating masters from non-masters.

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